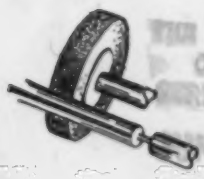
Grinding and Finishing

WHEELS • GRINDING • HONING • LAPPING MACHINES • ACCESSORIES • PORTABLE GRINDERS • TUMBLING • ABRASIVES

The Magazine Devoted Exclusively to Abrasive Operations

★ FEATURES



Automatic Grinding Innovations Help Plymouth Get 150 V-8 Engines an Hour

Tricky Problem for Allis-Chalmers: Form Grinding 1500 Jet Blades

Engineering the Proper Dressing Tool—Part II

ALSO IN THIS ISSUE

Shop Hints and Kinks

Safety

Letters to the Editor

Free Literature

What's New in Equipment and Materials

JUNE 1956

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Grinding and Finishing

Contents

Editor's Page 21

FEATURED ARTICLES

150 V-8 Engines an Hour 23
by Jack Kenyon, Associate Editor
Diamond Dressing Tool 27
by D. J. Wallace
Form Grinding 1500 Jet Blades 37
by J. L. Bryant
Solder Those "Unsolderable" Materials 42
Grinding Curved Surfaces on Toggle Cam Shoes 44
Pressure-Blast Your Carbide Tools 46
Grinding Safely 50
by Edmund Mottershead
Determining Diamond Concentration in a Diamond Wheel 51
by Fred W. Lindblad
Shoulder Grinding 52
by Christopher H. Hill, Jr.
California Grinding Wheel Plant for Norton Company 78
Brown & Sharpe Establish Precision Center in Providence 81

SHOP HINTS AND SHORT CUTS

Holding Devices for Surface Grinder 60
Accessories for Magnetic Chuck Aid in Set-Ups 61
Lifting Beam for Ganged Grinding Wheel 62

DEPARTMENTS

Letters to the Editor 4
Available Literature 56
What's New in Equipment and Materials 64
News of the Industry 82
Index to Advertisers 85

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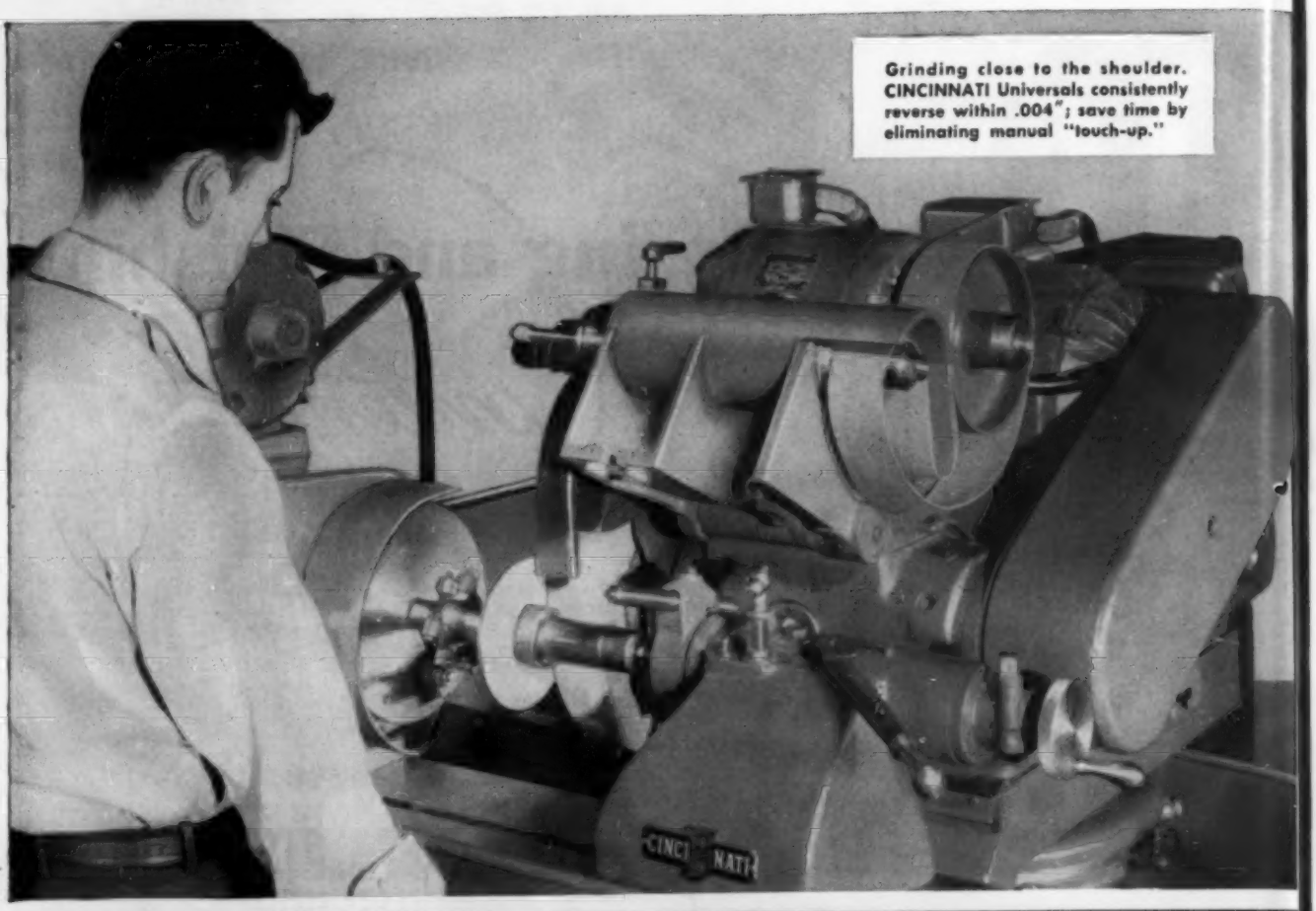
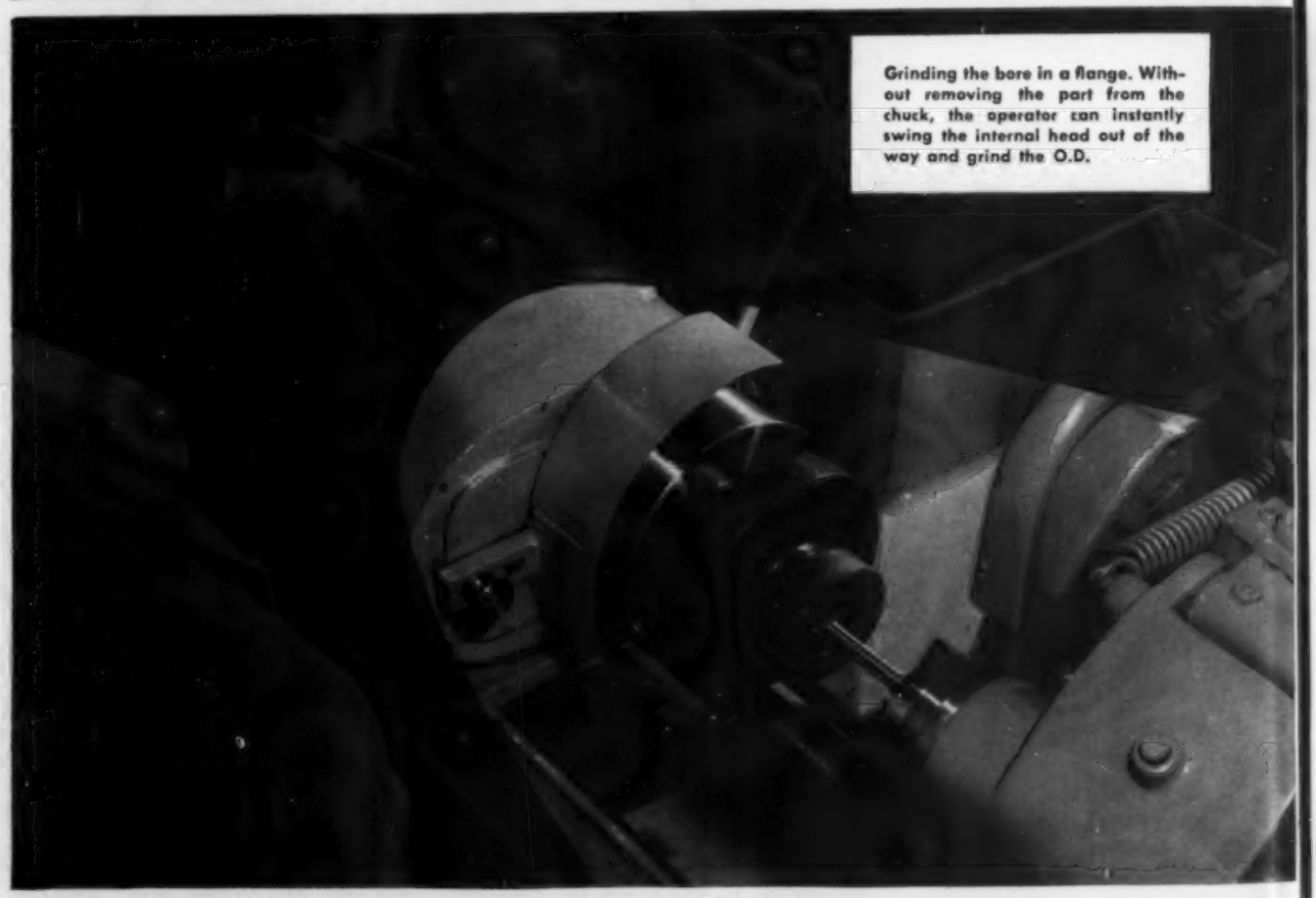


Grinding close to the shoulder. CINCINNATI Universals consistently reverse within .004"; save time by eliminating manual "touch-up."



Grinding the bore in a flange. Without removing the part from the chuck, the operator can instantly swing the internal head out of the way and grind the O.D.

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Cincinnati's setup timesavers

reduce cost of your

small lot precision production

Setup time looms large in the cost of small lot production. Whatever you do to reduce it helps everyone in the shop. To keep this element of cost at the lowest possible level, new CINCINNATI® FILMATIC Universal Grinders are equipped with many features. Just consider the possibilities of these four:

1 Hinged Internal Grinding Head —swing it down and tighten one bolt—that's all

2 FILMATIC Grinding Wheel Spindle Bearings—require no adjustment for any quality of finish or stock removal

3 Speed Ranger Headstock Drive —instantaneous finger-tip selection of infinite number of speeds; A.C. motor

4 Standard Headstock Spindle Nose—receives standard lathe chucks; quick change adapter available

Other ways in which new CINCINNATI FILMATIC 12", 14", 18" Universal Grinders can reduce costs in your shop are outlined in catalog No. G-663. May we send a copy to you? You will find brief specifications in Sweet's.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI® FILMATIC 12" X 36" UNIVERSAL GRINDING MACHINE

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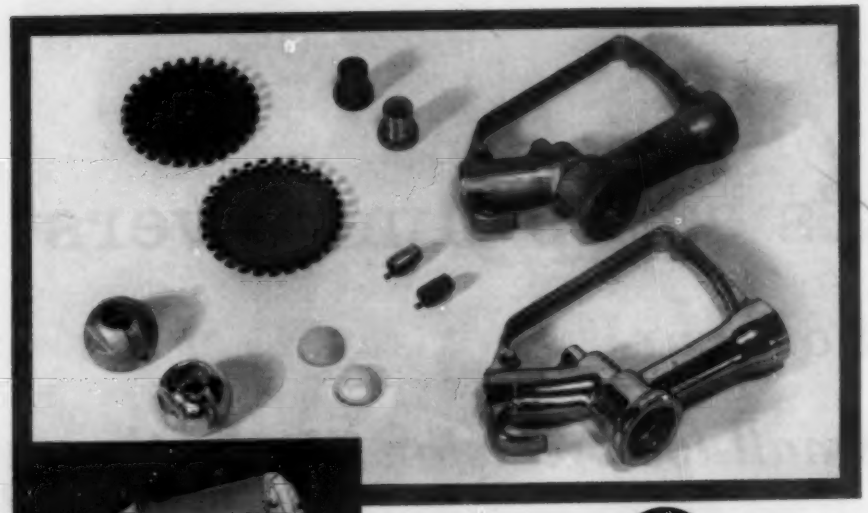

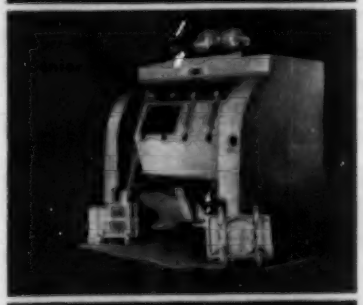

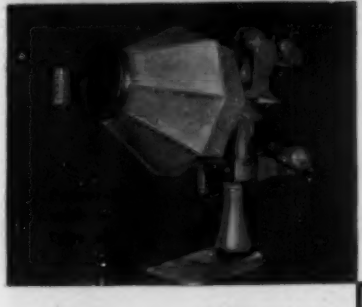

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DON'T depend on antiquated machines and out-dated methods. For *controlled* production finishing of wood, metal, plastic, rubber, and other parts, GLOBE equipment is carefully engineered to suit the demands of your job and your production volume.

DON'T buy any barrel finishing equipment until you have seen the new GLOBE Power Tilt line which features the time-proven, open-end barrel with conveniently located push-button controls for loading and unloading at the touch of your finger. The Power-Tilt line is available in thirteen capacity ratings and a choice of six barrel styles.

DON'T fail to get all the facts. Since 1902 GLOBE has provided industry with fine finishing equipment . . . equipment that is easy to operate and maintain.

DO take advantage of GLOBE'S vast files of case histories and know-how. Our free Test Laboratory is open for your convenience and our trained sales engineering staff will be pleased to help you determine the right equipment for your job.

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CASALBI COMPANY
544 Wayne Street, Jackson, Michigan

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Letters to the Editor

Orchids from Overseas

Up to now I have enjoyed very many articles of GRINDING and FINISHING. Being consultant engineer for coated abrasives I long ago interested my company (Norddeutsche Schleifmittel Ind., Hamburg) for a subscription. Since then the constant covering of GRINDING and FINISHING has resulted as very helpful in coordinating the various performances for special recommendations as well as for tips for grinding specialists and engineers. We have no equivalent to your magazine over here in Germany.

Now I have ordered a subscription for my own reference file, contacting the Buch-und Zeitschriften Union, Hamburg, which confirmed the order recently.

Enclosed you will find two business reply cards. I should be very grateful if you could arrange these for me.

I am also very interested in a reprint of each of the following articles:

Abrasive Grains by Joseph J. Forrester

Where and How You Can Use Abrasive Rolls by Robert McAdams and James L. Erickson

Centerless Grinding, reprint of complete series.

Heinrich Osterrath
Consultant Engineer
Norddeutsche Schleifmittel, Ind.
Hamburg, Germany

Centerless Grinding

Commencing with your December 1955 issue and recently ending with your April 1956 issue, there were five articles on the subject machines.

I heard from someone that these five articles had been gathered together and reprinted in booklet form. If that is correct, we would like to enter our order and you may use this letter as authority to supply us with 300 such booklets containing the five articles.

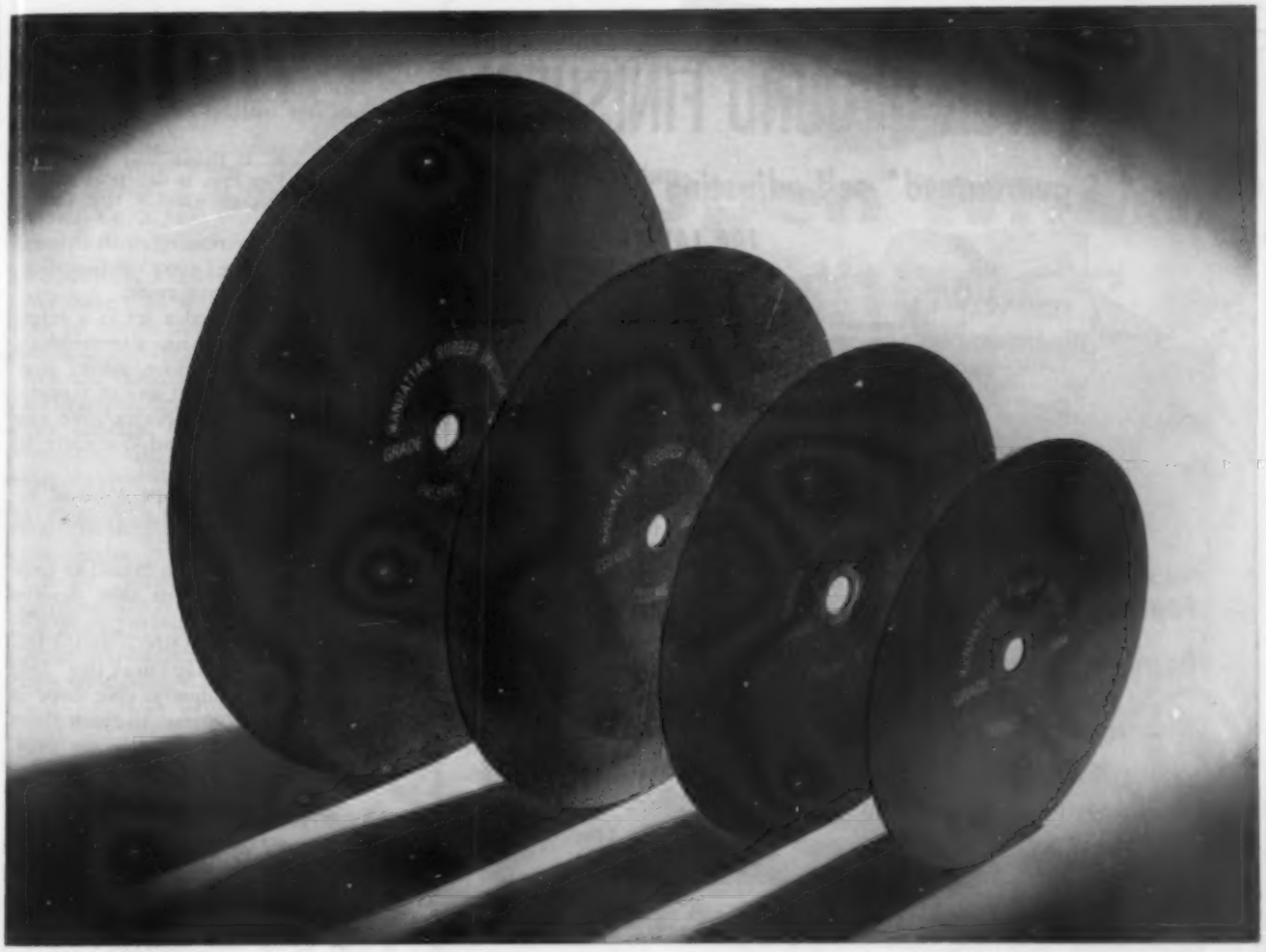
In the event this is impossible, we would appreciate the authority to reprint these five articles via offset lithography with proper credit to your very good book as the source of information.

A. F. Stevens, Advertising Mgr.
Van Norman Machine Co.

Please put us down for thirty copies of the Centerless Grinding article.

While we do not manufacture Cen-

(continued on page 6)



Cleaner Cutting . . . Longer Wheel Life with MANHATTAN CUT-OFF WHEELS

Safe, fast, clean cutting over sustained periods saves you both time and money. Manhattan Cut-Off Wheels give you cleaner cutting at higher speeds because every wheel is custom-bonded for your specific cut-off job . . . whether you work with hardened or soft steel, light gauge tubing or critical alloys. New Manhattan developments in both rubber and resinoid bonds account for this greater cutting efficiency . . . and longer life for the wheels. In factories where records are kept of the number of cuts per wheel, Manhattan wheels have proved they do a better job . . . and *last longer* than any other wheels.

Manhattan Cut-Off Wheels are custom-manufactured for your requirements in the widest range of types and sizes. Manhattan Abrasive Wheel engineers will assist you in specifying the exact construction to improve cut-off operations at your plant. They'll show you how you can save time and money . . . get "More Use per Dollar" . . . with Manhattan Cut-Off Wheels and other types of high speed, heavy duty wheels.

RM-030

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

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with J & S guaranteed* self-adjusting live centers

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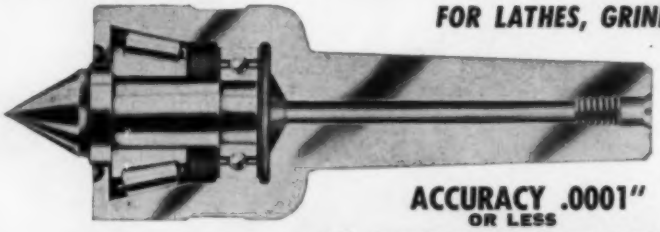

ACCURACY .0001"
OR LESS

with PERFECTION FREE CENTERS
SPINDLE TYPE
***GUARANTEED FOR 2000 HOURS FOR ONE YEAR**

tapered Timken bearings and design accept heavier loads with guaranteed accuracy.

SIMPLE DESIGN:

Only six parts, the main body is one piece which serves as the cup for the roller bearing on which spindle turns. This permits a much greater capacity bearing in the same size body.

AUTOMATICALLY ADJUSTS FOR WEAR:

Notice the clearance behind ball bearing which allows the whole bearing assembly to move back, automatically compensating for wear on roller bearing. This maintains center's point to original concentricity.

ABSOLUTE CONCENTRICITY AND ALIGNMENT FOR BEARINGS:

Both conical and cylindrical bores of body are ground at same setting in work head. Point is ground under load in its own bearings to insure running dead true.

Design plus self-adjusting features provide accurate and chatterless grinding.

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2 to 7	6 to 20	7 to 18	10 to 24	.8125 1.3350 1.7500
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terless Wheels we like to have our salesmen conversant with all phases of the Grinding Wheel business.

Thus our interest in your very fine article.

A. T. Dalton
Vice Pres. in Charge of Sales
Chicago Wheel & Mfg. Co.

We have been reading with interest the five articles on Centerless Grinding published in your magazine.

We have assembled a set as a reference and find that it has a tremendous appeal. We are therefore, asking if it be possible to get eight sets of reprints of the above named articles. We can then assemble them and distribute to the interested persons.

I would also appreciate a set of reprints which were listed on page 45, of the February 1956 issue.

We would also like to extend to your editors the compliments they deserve for the material and manner of presentation which GRINDING and FINISHING is rapidly making felt throughout the industry. We hope it will be able to continue to reach those who actually are engaged in the field.

H. S. Hunt, Chief Tool Eng.
Bulova Watch Co., Inc.

P.S. If you have any of those cards, "Who, if not you? When, if not now?" I would like to have one.

I have recently had in r[illegible]ssion a copy of the GRINDING [illegible]N-ISHING publication which is [illegible]lished by your organization.

Glancing through this publi[illegible]on, I find a number of interesting articles which prove to be of value in solving many of the complex problems which we are having in grinding.

I would appreciate having my name carried on your mailing list. I am particularly interested in receiving reprints on Centerless Grinding which are being run in your publication.

Paul R. Kautz
Gen. Foreman, Tool Dept.
The W. L. Maxson Corp.

The five-part series on Centerless Grinding is now available in one reprint at 35c per copy.

Di-Saver

Would you please forward to me the address of the National Diochemical Company in Illinois. We are interested in getting more information regarding an article you ran for them in GRINDING and FINISHING on their Di-Saver.

E. J. Bushey, Chief Engineer
Machine Design
Union Twist Drill Co.

We would like additional information on the Di-Saver.

As we have been unable to find an address for National Diochemical Com-

pany, other than Chicago, Illinois, we are wondering if you might be able to give us this information, or, possibly, send this letter directly to them for answering.

Leonard Armstrong, Chief Eng.
W. F. Meyers Co.

The address of the National Diochemical Co. is 3106 W. Lake St., Chicago.

Information, Please

We have read with interest your articles on barrel tumbling in GRINDING and FINISHING.

We are manufacturers of hardwood products, principally paint brush and utility handles. Recently we have experimented with tumble-sanded handles using chopped up sandpaper and with pumice. Results have been good, but we are looking for a medium to give better results.

Can you please advise of a source for aluminum aloxite pellets? Can you suggest a source of some medium that in your opinion would produce better results on sanding hardwood?

H. A. Harrington, Works Mgr.
Holgate Brothers Company

One of our subscribers in Norfolk, Va. has requested information on an Andrus Electric Grinder.

We are unable to locate this item in our files, and are wondering if you have any information as to the name and address of the manufacturer.

Oliver Brothers, Inc.

Grinding Standards

I was very much impressed by the 4th article in your series, "Development and Use of Time Standards From Standard Data Grinding Operations." Will you please send me 5 tear sheet reprints of the first 3 articles?

Tyler E. Williams, Jr.,
Ind. Eng.
Ordnance Management
Eng. Training Program
Rock Island Arsenal

Abrasive Grains

I have enjoyed the articles on grinding standard data by E. A. Cyrol and would appreciate two sets of tear sheets of the four articles if they are still available.

A. W. Jarman
Standards Supervisor
Tuthill Pump Co.

Tear Sheets sent.

Barrel Finishing

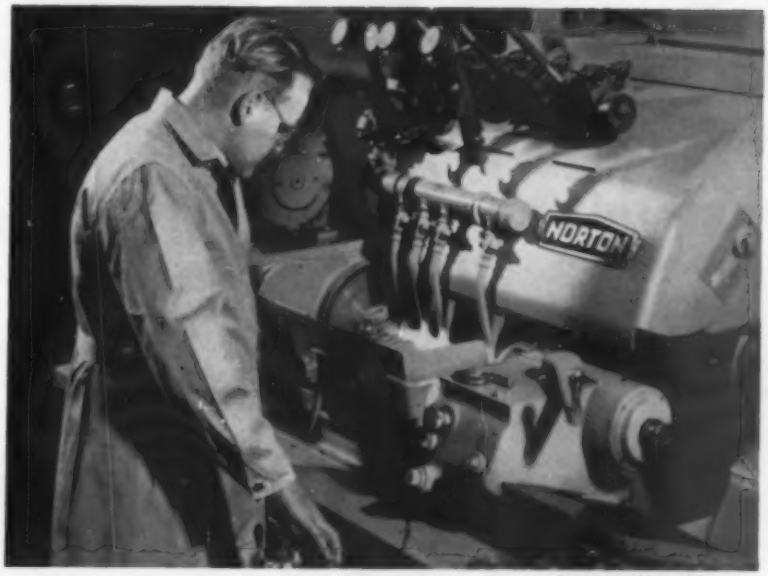
We have read your series on barrel finishing in GRINDING and FINISHING magazine which was written by Mr. M. S. Shipley and Mr. Wm. Biebel of the Esbec Barrel Finishing Corp.

We would like to know if it would be possible for us to purchase reprints of this article and at what cost. The quantity of 200 copies is being considered.

R. I. Roth, Vice Pres.
White-Roth Machine Corp.

PRESTO!

an "Open Wheel" with "1500"



Courtesy of Norton Company

Grinding operations in a great many plants are impeded by slow settling of chips . . . clogged coolant lines . . . excessive foam . . . all of which result in costly loss of efficient grinding action. *Worse yet,* "loaded" wheels make it impossible to get clean stock removal and the desired finish.

Even the finest grinding machines are only partially efficient under conditions such as these. Seasoned operators know what is needed — a change to the proper coolant!

Shop superintendents will tell you the answer: Use *W & B Concentrate* **"1500"** Results are astounding and immediate. **Chips settle immediately; coolant lines run free; foaming stops as if by magic. Wheels are "open" and the result is keener grinding action and cleaner stock removal.** Case histories* of many such "1500" successes are at hand in the W & B files.

To know more about the advantages of using "1500", write for W & B Catalog Page A-3; or call in the W & B Industrial Lubricants Expert. Take advantage of W & B 's 67 years of experience and know-how!

(*Names on request.)

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THE WHITE+BAGLEY CO.

WORCESTER, MASS. • DETROIT, MICH.

Originators of Grinding Lubricants

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—until you've tried

DAYTON SAFETY GRINDING — — — — — — WHEELS

Have you tried Dayton Safety Grinding Wheels lately?

If not, you are missing a real thrill in grinding wheel performance—and passing up real savings in time and labor.

Don't miss another day—make your next order for Dayton Safety Grinding Wheels.

Write for catalogue or name of nearest distributor.

SIMONDS WORDEN WHITE COMPANY

1101 Negley Place • Dayton 7, Ohio

Circle No. 206 on postpaid card

I have read a few issues of GRINDING & FINISHING. They have helped me greatly in my work as an industrial engineer.

The articles by E. A. Cyrol on standard data pertaining to grinding were very useful as were the articles on "Precision Barrel Finishing" by Morris Shipley and William Biebel.

At this time would it be possible to obtain tear sheets of the precision barrel finishing article which appeared in the November 1955 issue?

Also would it be possible to have my name placed on your mailing list so that I may receive future issues of GRINDING & FINISHING?

Carl W. Olson
Supervisor of Methods & Stds. Dept.
Harington & Richardson, Inc.

I would like to be put on your mailing list for your monthly publication, GRINDING & FINISHING, if at all possible.

I have read the December issue and find it extremely interesting and full of valued information. Particularly timely is the article on Precision Barrel Finishing and I wonder if I could secure the back articles parts 1, 2, and 3 plus the December issue on part 4. We have just installed a barrel finishing setup and I would very much like to have the operator read these articles as they cover the complete thought and action process involved extremely well.

May I commend your organization on a very well written technical magazine.

Alvin Barr
Production Engineering Manager
Teleflex, Inc.

Are reprints available of your current article Precision Barrel Finishing by Morris S. Shipley and William A. Biebel?

If so, how can we obtain several copies.

P. M. Landis, Ind. Eng.
Auburn Button Works, Inc.

Reprints are now available at 35 cents a copy.

Will you please send me one each of the following reprints as mentioned in the December issue of GRINDING & FINISHING: Abrasive Grains, and What is the Smallest Radius That Can be Dressed With a Wheel Dresser.

J. M. Meeker

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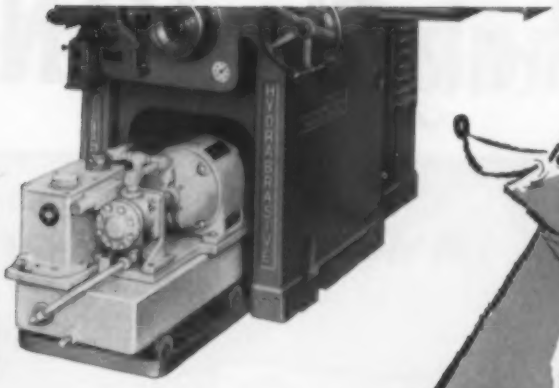
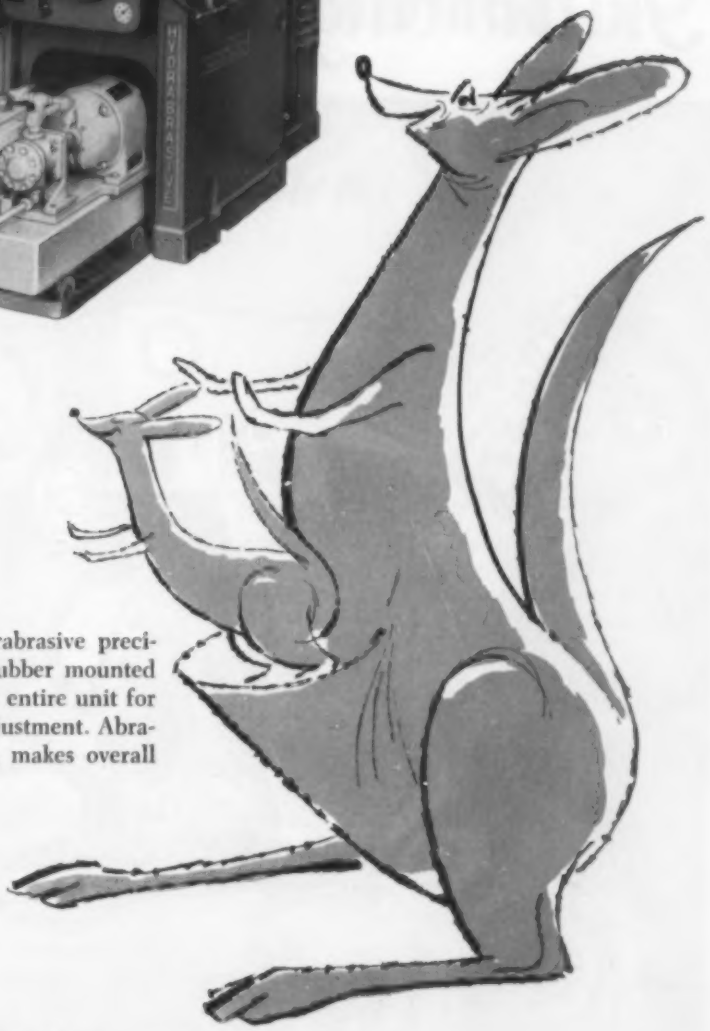
Roll Out Hydraulic Maintenance!





A standard feature with

HYDRABRASIVE SURFACE GRINDERS!

No. 1224 | 12" x 24" x 12"

Hydraulic units with Hydrabrasive precision surface grinders are rubber mounted on casters. Just roll out the entire unit for easy, fast inspection and adjustment. Abrasive unit construction, too, makes overall maintenance a breeze.

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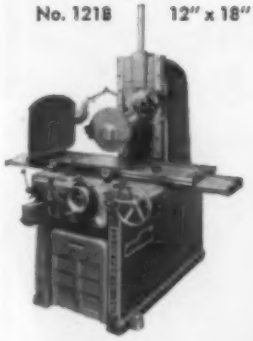

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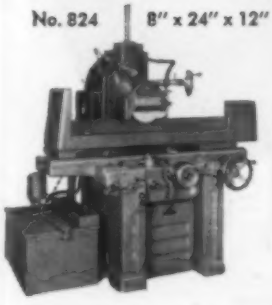
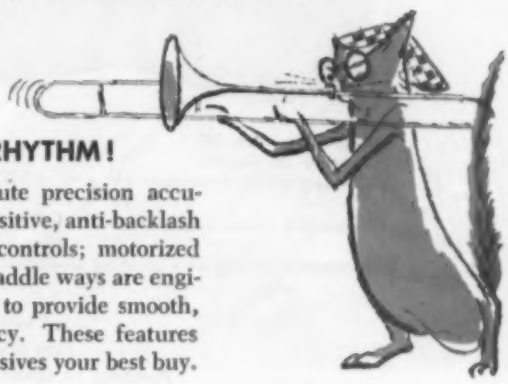


SIZE VARIETY:

Whatever your precision surface grinding requirements, there's a Hydrabrasive model engineered for you. You can have extra capacity, too! At your option, Hydrabrasives can be delivered with a full 18" capacity under the wheel. A 5 H.P. spindle is available, too, with a 1½" wide grinding wheel.



WE'VE GOT RHYTHM!

Smooth rhythm for absolute precision accuracy. Hydraulic power; sensitive, anti-backlash feed cross screw; simple controls; motorized spindles and ball bearing saddle ways are engineered into Hydrabrasives to provide smooth, easy operation and accuracy. These features make economical Hydrabrasives your best buy.

ABRASIVE
Machine Tool Company
East Providence, Rhode Island

FREE! Send your name and address on a two-cent postal for illustrated catalogs. No obligation.

ABRASIVE
ACCURACY QUALITY PRODUCTION

For Forty Years...First For Accuracy, Economy

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Introducing The VAN NORMAN

Van Norman No. 2C
Capacity: 0" to 4¼"
Grinding wheel available: 24" x 4" x 12"; 24" x 6" x 12"; 24" x 8" x 12"
Regulating wheel available: 12" x 4" x 5"; 12" x 6" x 5"; 12" x 8" x 5"
Automatic cycling and gauging available.

**Don't wait . . . for extra profits install a Van Norman Machine now!*
They are available on many purchase plans — Outright sale . . .
Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . .*
See your dealer or write Van Norman Company
Conditional Sales Contracts not available to Export.

VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

No. 2C Centerless Grinder

Machine with Work Capacity 0" to 4¾"

Precision Grinds Parts Fast . . . Holds Tolerances . . . Cuts Grinding Costs

Newest in the expanding line of Van Norman grinders, is the No. 2C Centerless Grinder. This rugged, precision-built, heavy-duty grinder incorporates many outstanding, exclusive advantages that result in more work per operator, per work shift.

The No. 2C Centerless Grinder finish grinds many parts from solid . . . or finish grinds rough-turned parts. The No. 2C gives you the facilities of three centerless grinders without change-over time . . . standard grinding for throughfeed work, standard grinding for infeed jobs, and equipped with crush dressing attachment, it form grinds and does profile work.

Phone, wire or write for full details on the New Van Norman No. 2C Centerless Grinder, today.

Outstanding Advantages

Hard chrome plating of regulating wheel slide after hand scraping, preserves original factory built-in accuracy.

Grinding wheel spindle is of a unit type construction . . . totally enclosed with double-row super-precision bearings, sealed and lubricated for life, assuring chatterless troublefree operation.

Spindle requires no warm-up period, eliminating "creep" which has always been a problem in grinding operations.

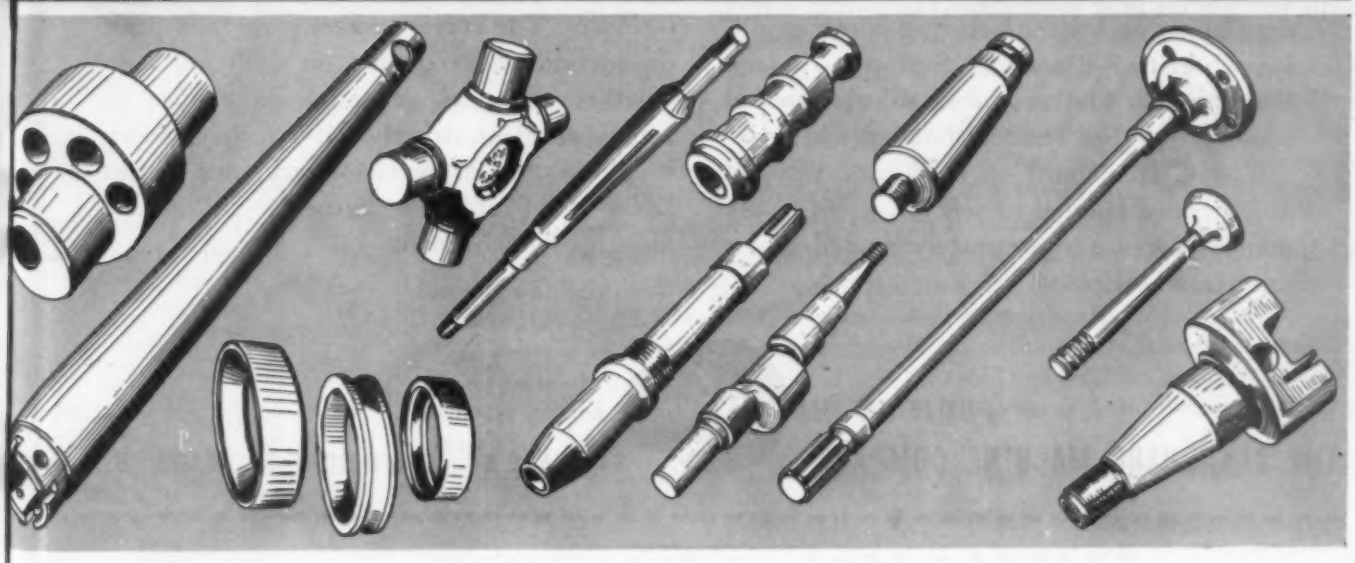
Infinitely variable regulating wheel drive.

Totally enclosed fan cooled, dynamically balanced 15HP main drive.

Independent hydraulic wheel truing devices for each wheel.

Fine hand wheel adjustment on diameter of work piece.

Grind Parts Like These Accurately, More Economically



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man on the wing

Great things were happening in aviation 46 years ago when we launched the idea of scientifically selected industrial diamonds and set up our little factory to make the diamond tools that were to be so vital to aviation.

Louis Bleriot had won $5,000 offered by London Daily Mail for the first airplane flight across the English Channel. Piloting his 24 H.P., 450 pound monoplane to the dizzy height of 250 feet, he had spanned the 21 miles of open water in 37 minutes. The challenge echoed across the Atlantic and 1910 saw a brilliant parade of dramatic "firsts."

Glenn Curtis won $10,000 offered by New York World in a 150 mile race with a train. Charlie Hamilton won $10,000 offered by New York and Philadelphia newspapers for flying a round trip between those cities in one day. Walt Brookins won $5,000 offered by Atlantic City Aero Club for reaching a height of one mile.

Ely took off from the deck of a cruiser and flew two miles to Norfolk in the first ship take-off flight. Phil Parmalee got $5,000 for flying five bolts of silk from Dayton to Columbus, Ohio, in a store publicity stunt—the first merchandise shipped by air.

*Engineered Diamond Tools** were also a "first" in those early years but their dramatic moment came when war brought critical need for speed and precision in engine production. Then they proved abundantly that nothing cuts like a diamond and that no diamond tool performs like one that is engineered to its job.

**Engineered Diamond Tools* means diamond tools *engineered* to the job and *guaranteed* to do it.

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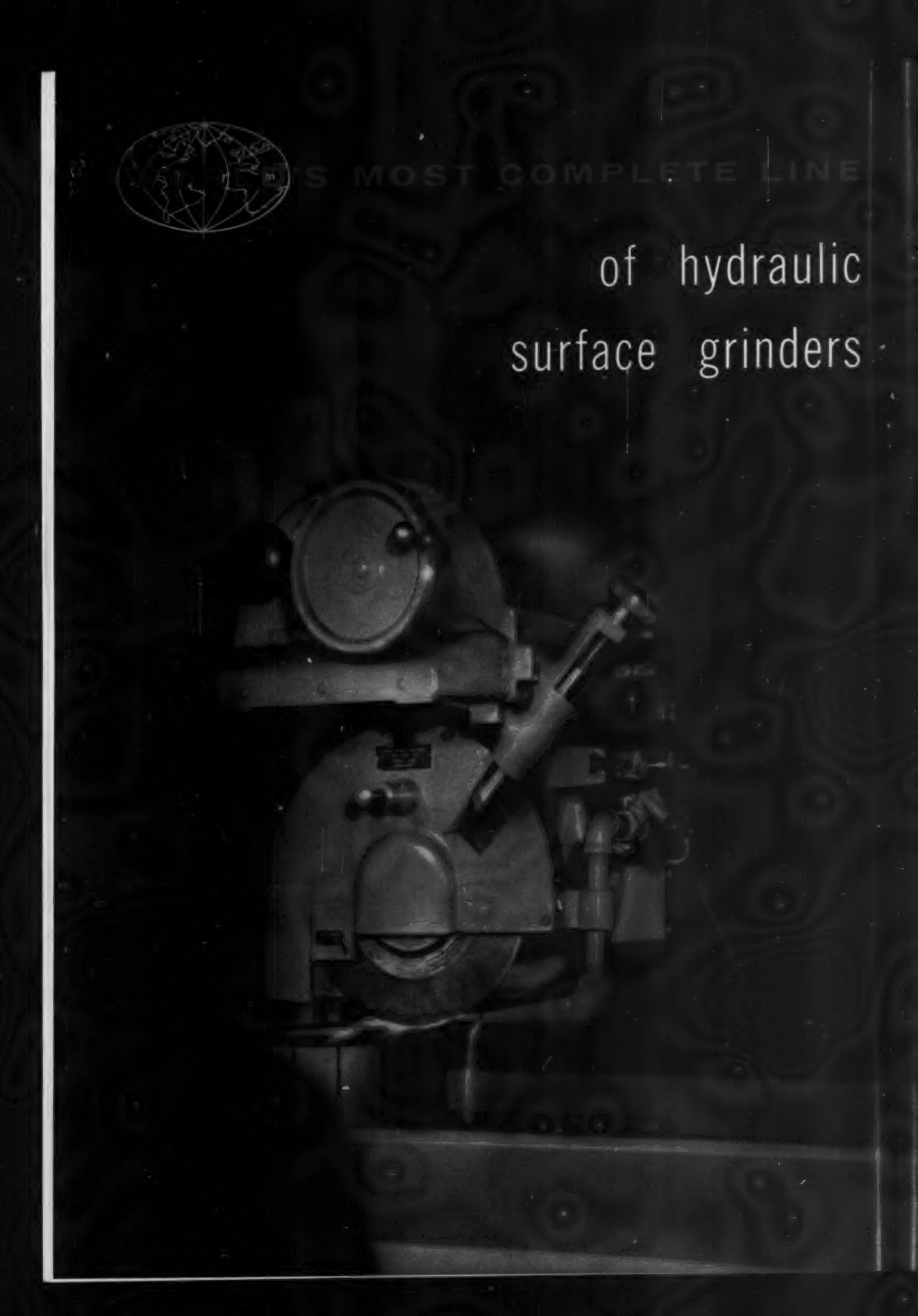
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Offers both power and precision for heavy duty production . . . fast, accurate

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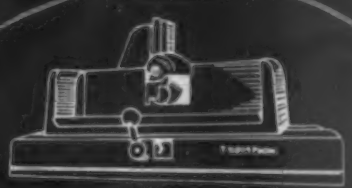

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are tops for *Surface* grinding

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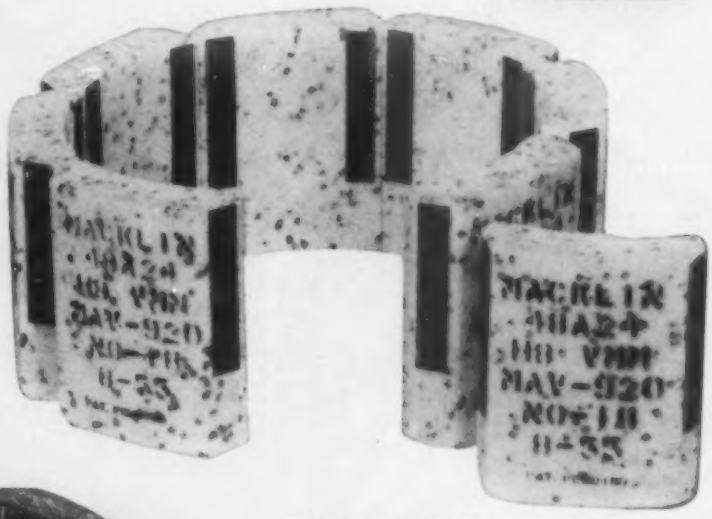
Whatever your grinding job, if you are using segmental wheels, you owe it to yourself to try the new MACKLIN M.M. process segment. The unique construction of fine abrasive in pellet form, engineered in these wheels, gives a constant flow of fine abrasive particles between the wheel and the work, thereby eliminating the time and cost consuming dressing operations so prevalent with most grinding wheels.



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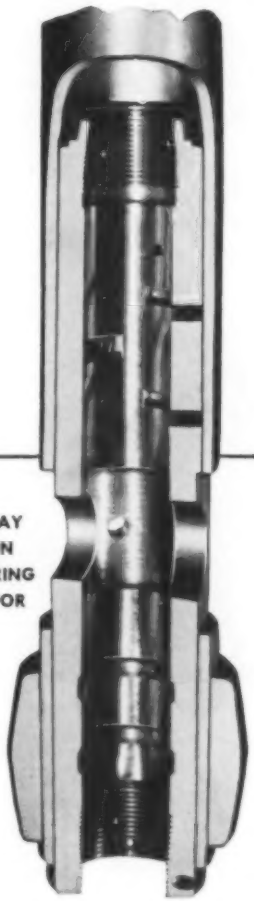
MICROHONING*

with self-dressing abrasives generates consistent

Functional Surface Finishes

Microhoning, the low-velocity abrading process consistently produces part after part exactly to your specified surface finish requirements, because the abrasive grits always remain sharp.



CUTAWAY SECTION OF STEERING ACTUATOR

Monroe Auto Equipment Co. designed its power steering unit to withstand rugged use while maintaining sensitive control. In the final processing of the hydraulic steering actuator, Monroe chose Microhoning to obtain diametric accuracy, consistent finish and to generate geometric precision.

The rough and finish Microhoning operations removed .005" stock from an interrupted bore 1.125" in diameter and 6⅜" long.

MATERIAL AND HARDNESS: SAE 1118 steel, Rockwell 45-50C

TOLERANCES: size—.0003"
roundness and taper—.0001"

FINISH: 25 microinches or less

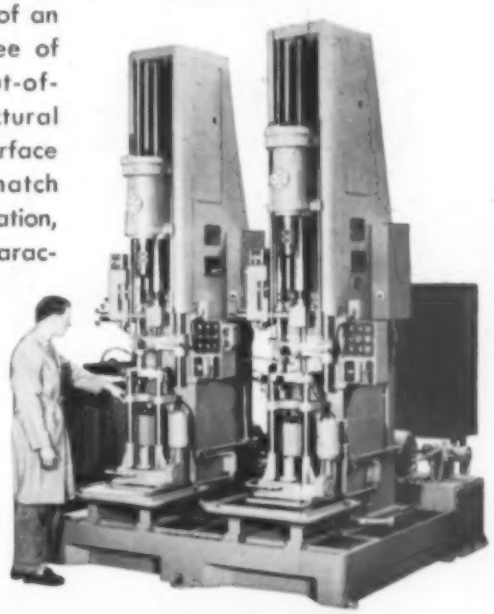
CYCLE: rough Microhoning—35 to 40 seconds
finish Microhoning—15 to 20 seconds

MACHINE: Double-column Model 740 Hydrohoner

SELF DRESSING ACTION OF THE ABRASIVES . . . is accomplished by the rotation and reciprocation of the Microhoning tool—the combined motion continuously changes the direction of force on the abrasive grits and keeps them dressed.

EFFICIENT STOCK REMOVAL . . . results from the many sharp-cutting grits acting simultaneously over a wide area of work surface. In this manner, the effect of heat is also minimized. Of all production processes, Microhoning least disturbs the sub-surface structure of the work.

FUNCTIONAL SURFACE CHARACTERISTICS . . . are obtained in one uninterrupted cycle. Microhoning generates accuracy within millionths of an inch . . . surfaces free of waviness, taper, out-of-roundness and structural stresses . . . uniform surface finish and a cross-hatch pattern for best lubrication, sealing and wear characteristics.



For more details on this application write for CROSS-HATCH Vol. 8, No. 1

***MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH**

MICROMATIC HONE CORPORATION

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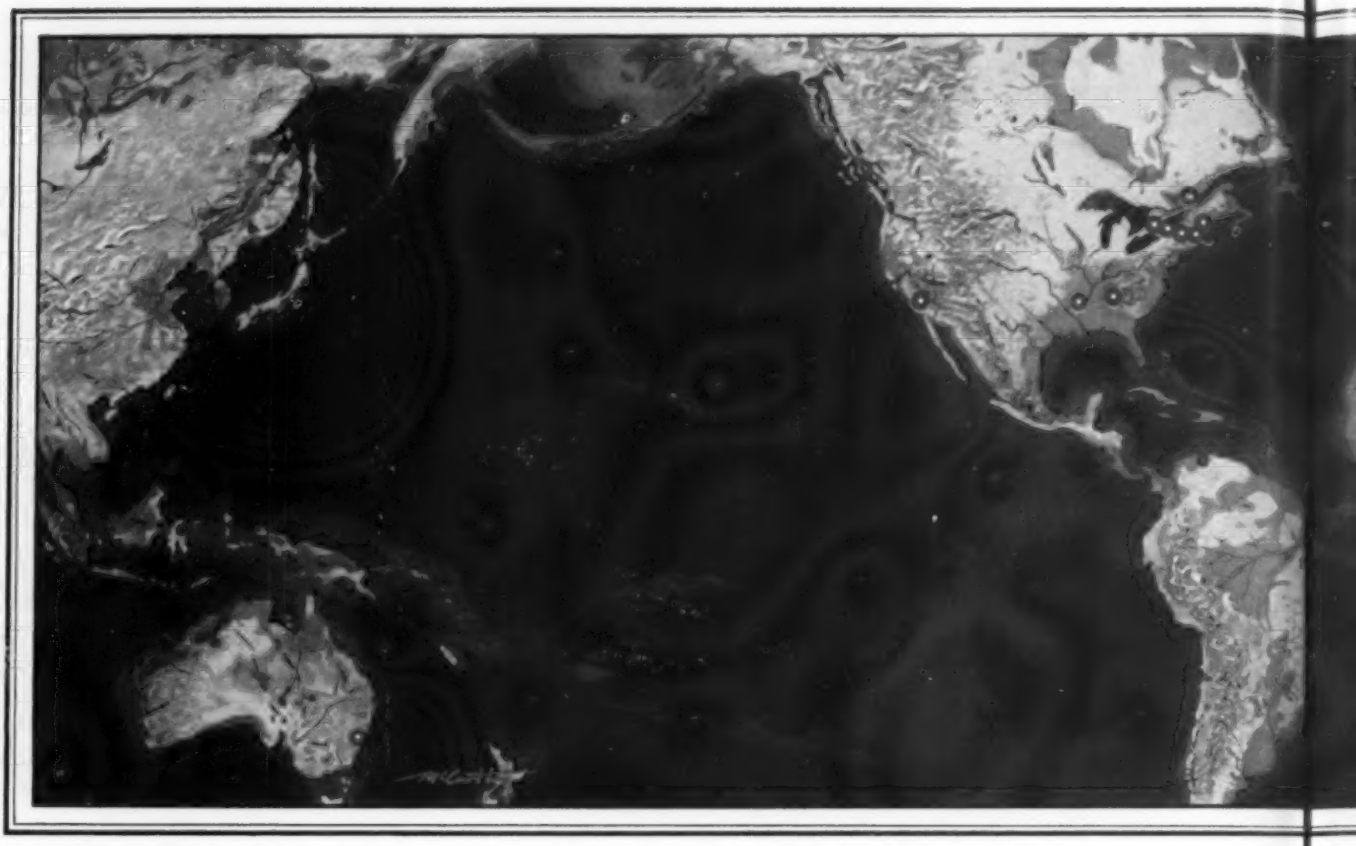
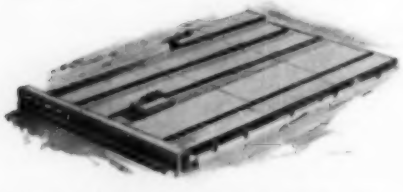


All industry shares

Ten new Norton Plants . . . in six countries . . . within seven years . . . tell a story of continuing, world-wide leadership

No industry can exist without abrasives. Even the very few industries that do not perform abrasive operations themselves — in manufacture and maintenance — depend upon them for the tools and equipment they use.

That is why every industry has a share — and a stake — in the growth of Norton Company. Norton owes its leadership in the manufacture and development of abrasive products to the high

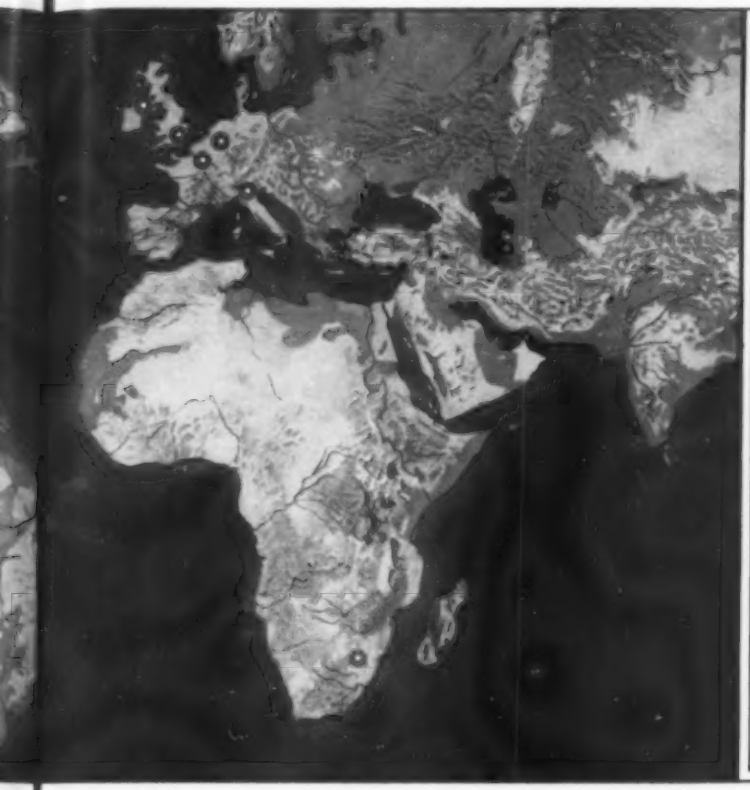


1948 — Worcester, Mass. Plant No. 7 in "Norton City" is the largest, most modern ever built for grinding wheel manufacture. Here, revolutionary advancements in processing equipment and techniques produce grinding wheels of unequalled quality and uniformity.

1951 — Isando, Union of South Africa. Located in the Transvaal near Johannesburg, and serving all Africa, this Norton plant produces a complete line of abrasive products. Thus Norton anticipates the needs of a continent that, industrially, is just awakening.

1951 — Troy, N. Y. This new building at the Behr-Manning division produces waterproof coated abrasive paper for finishing car bodies. Through its single huge machine the strip of paper base travels nearly five miles while being coated with Norton abrasive grain.

Making better products...



Across the world and still expanding

Abrasive and Grinding Wheel Plants — Worcester, Mass.; Santa Clara, Calif.; Hamilton, Ontario; South Africa; England; France; Germany; Italy

Behr-Manning Plants — *Coated Abrasives and Behr-Cat Tapes*—Troy, N.Y.; Canada; Australia; France; Northern Ireland; Argentina

Electric Furnace Plants — Huntsville, Alabama; Chippawa, Ontario; Cap-de-la-Madeleine, Quebec

Grinding and Lapping Machine Plant — Worcester, Massachusetts

Refractories and Electro-Products Plant— Worcester, Massachusetts

Norton Pike Plant — *Sharpening Stones* — Littleton, New Hampshire

Bauxite Mines — Bauxite, Arkansas

Main Office: Norton Company, Worcester, Mass.

in this steady growth

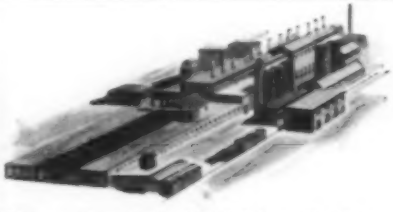
confidence it has built up among its customers all over the world.

This confidence can be measured — and the yardstick is growth. Steady growth since 1885, not only in this country but in many others. In the last decade alone the expansion of Norton Company has been extensive and rapid. Shown here are Norton plants built in the United States, Canada and the Union of South Africa since 1948.

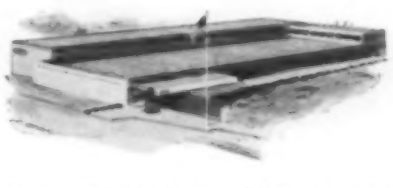
In addition, other new plants have been built in Australia, France and Northern Ireland.

NORTON
ABRASIVES

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



1953 — Cap-de-la-Madeleine, Quebec, Canada. Located in a region rich in mineral resources, this electric furnace plant produces CRYSTOLON* silicon carbide for abrasive and refractory uses. Norton's largest plant of this type is in Chippawa, Ontario.



1955 — Santa Clara, California. The better to meet the needs of the rapidly expanding West Coast market, this Norton plant manufactures a full line of grinding wheels, including diamond wheels. Norton is first to supply this complete West Coast service.

1955 — Huntsville, Alabama. This latest addition to the Norton international network is another electric furnace plant. Besides supplying NORBIDE* boron carbide, MAGNORITE* fused magnesia and fused stabilized zirconia, it will produce special products for the AEC.

to make your products better

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Free Technical Booklets

We need not spend a great deal of your time telling you about the value of Trade Associations. For here, as in everything else, the mere numbers of them prove their value. Nothing exists unless it performs its functions at a benefit; trade associations must benefit the ultimate consumer, or its hold on life is precarious indeed.

The Grinding Wheel Institute is a trade association serving the users of grinding wheels. It is not our purpose here to talk about the Institute, we are primarily concerned about the immediate value of its work as applies to you, the user of grinding wheels. Volumes could be written on that subject.

The Institute sponsors technical research projects which reflects in more efficient wheel usage. Some projects delve into the Why and How of the grinding process and while it may be too abstract for your immediate use, the practical results of such research will benefit you in time to come. In the fields of Safety, Standards, Technical Information, Statistics, the Institute performs valuable service.

One of the more important aspects of the Institute's work is the dissemination of technical knowledge through a 400-page textbook and a series of technical booklets. These technical booklets should be in the hands of everyone who uses a grinding wheel.

The following booklets may be obtained from the Grinding Wheel Institute at no charge. Merely write to the headquarters, 2130 Keith Building, Cleveland 13, Ohio who will send you the booklets you desire.

1. American Standard Safety Code for the Use, Care, and Protection of Abrasive Wheels.
2. Simplified Practice Recommendations R45-47, Grinding Wheels. Standard Shapes and Sizes.
3. Mounted Wheels and Points, Safe and Efficient Operation—Critical Speeds.
4. High Speed, Heavy Duty Grinding Machines — Maintenance of Swing Frame and Floor Stand Machines.
5. Handling, Storage and Inspection of Grinding Wheels.
6. Portable Grinding Machines—Safe and Efficient Operation.
7. Safe Speeds for Grinding Wheels —Established Rules for Efficient Operation.
8. Disc Grinding—Safe Rules and Methods.
9. Mounting Technique for Wheel Sleeves on Cylindrical Grinding Machines.
10. Specifications of Segments Used In Chucks.
11. Cutting-Off Wheels.
12. American Standard Markings for Grinding Wheels and other Bonded Abrasives.

Wm. J. Schleicher

Editor

OVER 200 SHAPES

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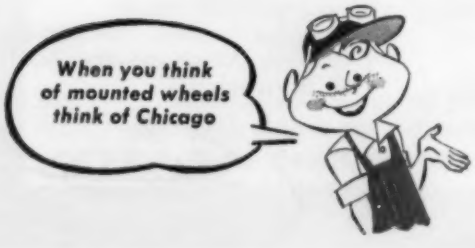
CHICAGO *Mounted Wheels*

CHICAGO MOUNTED WHEELS are manufactured under positive density control to insure peak job performance.

GUARANTEED to stay on their mandrels. They are perfectly balanced, easily dressed, and hold their shape.

SAVE TIME, MONEY, MATERIALS using Chicago Mounted Wheels. There is almost an infinite number of combinations of dimension, shape, grain size and bond.



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grinding — finishing
JUNE 1956

LINE OF CENTERLESS GRINDERS with connecting Cincinnati conveyors grind rocker arm shafts in Plymouth engine plant.

Innovations in automatic grinding are helping Plymouth achieve . . .

150 V-8 Engines an Hour

THE FORWARD LOOK
CHRYSLER CORPORATION

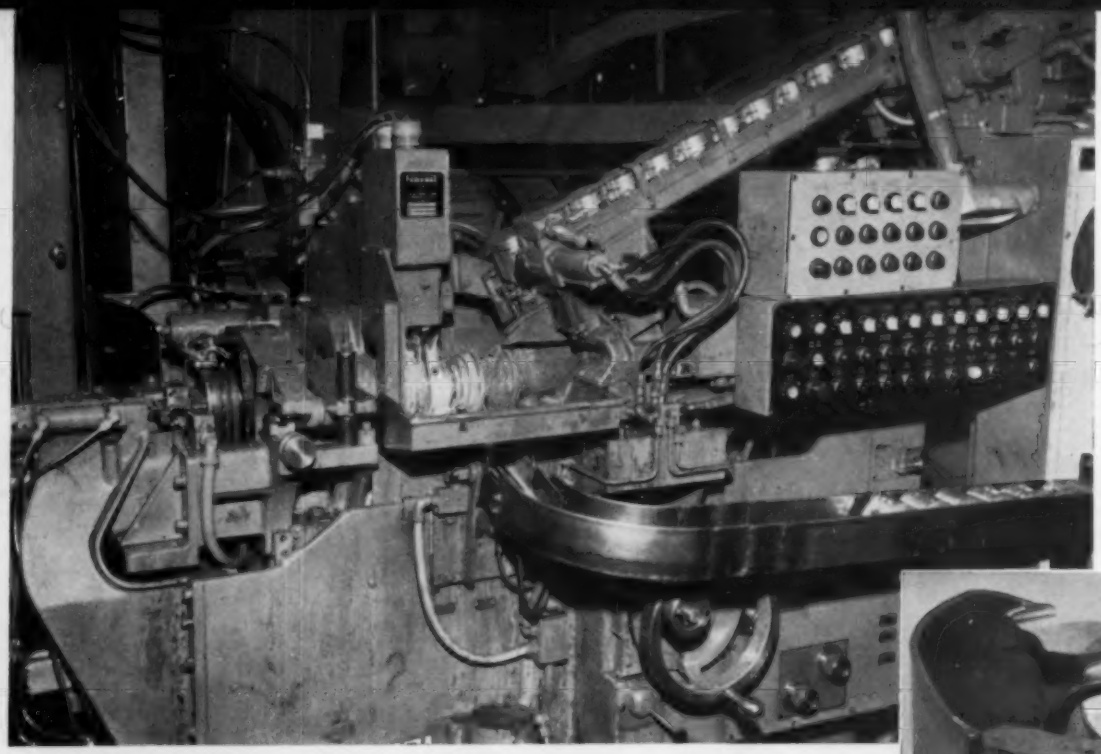
By Jack Kenyon
Associate Editor

- √ Automatic sizing method for grinding elliptical piston skirt
- √ Clutch housings are ground instead of milled for heavy stock removal
- √ Rocker arm shaft is centerless-ground on a continuous line

● Success of the program that gave Plymouth a 150-engine-an-hour plant in only twelve months was in no small measure due to the unique vendor relationships Plymouth set up for the program. Each supplier was in effect made a subcontractor to Plymouth for a particular portion of the processing, whether it was complete machining of a part or one operation in a sequence. The vendor was given responsibility for getting the operation up to specified production before turning it over to Plymouth, and was given a great deal of freedom in development of methods and selection of components, once the basic process has been decided on and the required degree of automaticity stated.

Simultaneous development of processing methods and design of the V-8 engine also aided immeasurably in the planning stages for the plant, giving manufacturing personnel an engine that is easier to build than would have been the case otherwise.

There are many interesting grinding operations in the new engine plant. A few that seemed particularly noteworthy are presented here. We are grateful to Henry Ibser, Plymouth Engine Division Master Mechanic; Paul Gielow, Tool Research Engineer; and Donald Graham, abrasive engineer, for their co-operation.



SKIRT GRINDER LOADING ARM takes part from loading chute and positions it for operation. Gaging arm of the Federal electronic size-control unit swings into position just after grinding has started, controls beginning of slow speed final finish portion of cycle and sparkout as major diameter of elliptical skirt reaches size. The 24 x 2¾ x 12 Cincinnati A-46-H6-V wheels operate at 6500 sfm.

RIB ON THE SKIRT CIRCUMFERENCE just below the wrist pin hole is typical of the help Plymouth process engineers are getting from engine designers. It enables the piston to roll, thus simplifying handling problems.

THE FORWARD LOOK
CHRYSLER CORPORATION

Grinding at Plymouth

continued

Electronic in-process gaging controls the piston skirt grinders

● A remarkable operation in the new Plymouth V-8 plant is grinding of the elliptical piston skirt, done by a line of 13 automatic Cincinnati piston grinders. Developed to meet Plymouth's requirements for this application, they incorporate automatic features which may well make them models for the industry in future programs. Of particular interest is the automatic sizing method employed.

The Plymouth V-8 piston is an aluminum alloy permanent mold casting with a Brinell 500 KG hardness of 95. Grinding was chosen for the finishing operation instead of conventional turning methods, because the impurities encountered in the aluminum pistons would cause excessive tool breakage and frequent setting. Grinding also permits much closer size control and better finish.

The skirt grinders' automatic features include automatic loading and part positioning, automatic grinding cycle with controlled sizing, and automatic unloading. Pistons come down the loading chute in an upright position and are picked off the chute by a pneumatic loading arm which swings them down to the chuck for the operation.

The grinding cycle consists of a varying number of fast infeed work-piece revolutions and slow infeed revolutions. These are governed by the electronic gaging unit to give the required elliptical skirt contour.

After the part is brought to size and is released, it drops into a chute and rolls to the conveyor pick-up point for movement to subsequent operations. The machine cycle gives a gross production of 125 pistons per hour. Plymouth is running the machine with a preset automatic dressing cycle of 100 grinds per dress.

Size control methods employed on these grinders are new for piston production and are indicative of the direction production grinding is moving these days.

The Plymouth setup employs electronic gaging during process—measurement of the peaks, or major diameter, of the elliptical piston—which is the im-

portant dimension to be gaged. In-process gaging permits continuous, proportional compensation rather than step-by-step size correction each time the wheel is dressed. This reestablishes the base point of the grinding cycle after each grind, and the result is continuous grinding of parts that are "right on" in size.

Working from a rough-turned skirt surface, stock removal for the grinding operations is between .009 and .012 in. Tolerances are plus .0005, minus .0000, and a 60 RMS maximum finish is specified. Coolant for the operation is Cimcool A-L in a fifteen to one concentration.

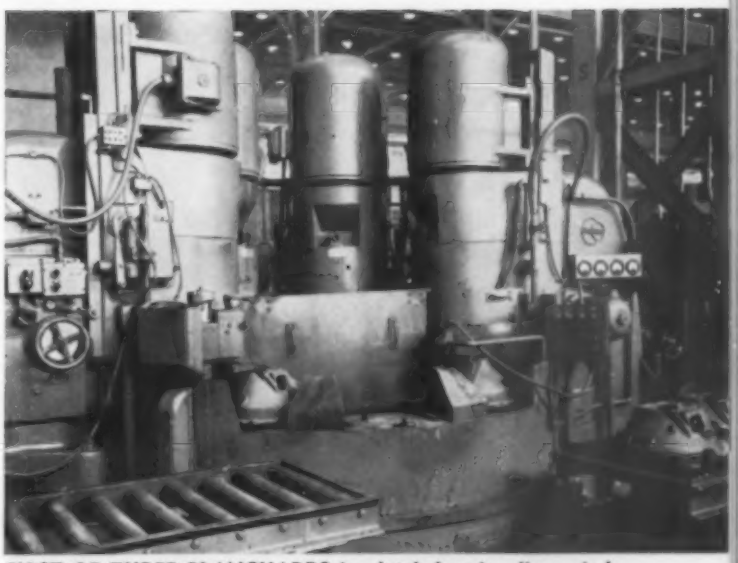
Grinding of clutch housings replaces milling in heavy stock removal operation

Plymouth is grinding the front, rear and lower faces of its V-8 clutch housings in heavy stock removal operations on a line of three Blanchard Model 22A4 4-head surface grinders. The cast iron housing, a traditionally difficult part to machine because of relatively thin walls, has lent itself well to grinding, and the operation is going very satisfactorily.

The gray iron housing castings, which have a 3000 kg Brinell hardness of 130-187, arrive at the first grinder of the line on a roller gravity conveyor. The operator fixtures the part for the first operation, grinding of the rear housing face, which is used as a locator in subsequent operations. Stock removal, about the same for all three operations, runs from .080 - .100 in., using 10-segment wheels, each segment 5-9/16 x 2¼ x 6. First three wheelheads mount C-20-K8-V wheels, while the third has a C-46-I-B. All are run at 6500 sfm. Limits on the three operations are .010 in., and a 150 rms finish is specified. Gaging is done by means of a fixed relation gage above the fixture table.

Dressing is done only once for the entire wheel life. This is done with a machine mounted Star dresser; after initial dressing, wheel breakdown eliminates further dressing. Coolant for the operations is Cimplus, in 75-1 concentration.

Second face to be ground is the front face of the housing. Last is the lower face, on the third Blanchard. Essential details of the second and third operations are the same as the first.



FIRST OF THREE BLANCHARDS in clutch housing line grinds rear face. High stock removal operation replaces milling traditionally used on housings.

LARGE FRONT FACE OF HOUSING is ground by second Blanchard. Same wheel specifications are used for all three machines of line; three heads do roughing, last does finishing.

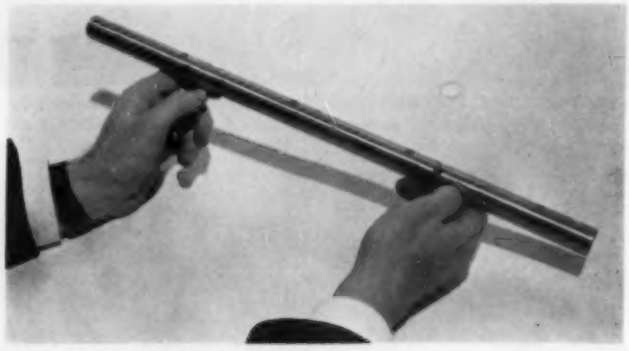
FIXTURE SETUP FOR THIRD OPERATION, on top face of housing. Finish for all three faces is specified as 150 rms.

THE FORWARD LOOK
CHRYSLER CORPORATION

Grinding at Plymouth

continued

Rocker arm shaft is centerless ground on a continuous line



MS 2108 WELDED TUBING SHAFT hardened to 48 Rockwell C is ground to limits of .001 in., finish of 25 micro minimum.

Throughfeed centerless grinding of the rocker arm shaft for the new Plymouth V-8 by a connected battery of five Cincinnati grinders for continuous automatic rough and finish grinding has proved to be a highly satisfactory, trouble-free operation.

Because stock removal for any one machine of the battery is relatively low, Plymouth engineers have found wheel life to be very good. Occasional attention by the roving setup men of the department is all that is necessary for the continuous operation.

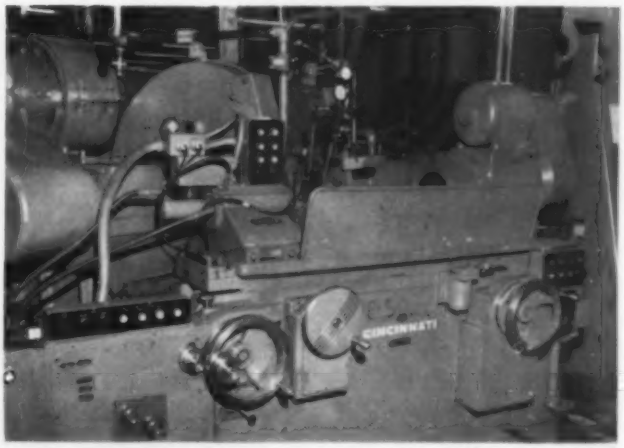
The shafts, of Chrysler specification MS-2108 approx. .45 carbon welded tubing, have oil holes and lubrication grooves drilled and milled in previous operations and are conveyor-fed automatically to the first machine of the battery. Induction hardening to a Rockwell 48 C minimum hardness is done just prior to grinding. About .010 in. stock is removed in the roughing passes, leaving approximately .010 in. for removal in finishing.

A .001 in. limit is held on size, and a finish of 25 micro is specified for the shaft. The roughing wheel specifications are A46-L6-V, and finishing wheels, of the battery are A60-J6-V and A80-L6-V. No difficulty has been experienced in meeting finish requirements, a 10 micro finish being commonly obtained in normal production. All wheels are run at 6500 sfm.

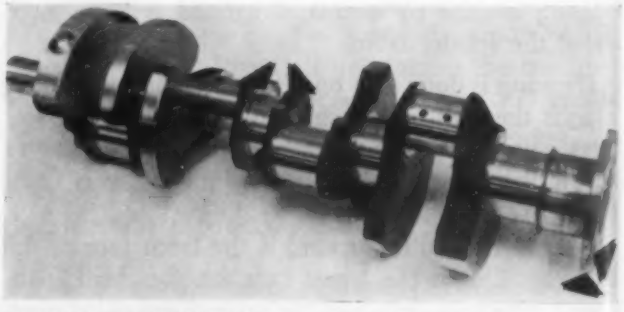
Automatic dressing cycle is set at 180 pieces per dress for roughing, 280 pieces per dress for the finishing machines. A Merz automatic checking gage sizes parts following the last operation. • • •

ONLY OCCASIONAL ATTENTION BY SETUP MEN is required in exceptionally smooth-running grinding operation of rocker arm shafts in Plymouth engine plant. Here is line of five Cincinnati centerless grinders with connecting Cincinnati conveyors.

Interesting Crankshaft Operation



IN COMBINATION OPERATION ON CRANKSHAFT, still in tryout and experimental stage, Plymouth grinds main bearing thrust walls with straight-in wheel, and face and OD of flange on end of shaft with angled wheelhead. Shafts are handled mechanically. Finished shaft, below, shows surfaces ground in operation.



FINISHED CRANKSHAFT. Arrows indicate surfaces ground in combination operation.

What's involved in engineering the proper

Diamond Dressing Tool

Continuing last month's feature which highlighted diamond dresser applications in the new Plymouth V-8 engine plant. Here the author discusses . . .

- More case histories of precision form grinding operations
- How problems were attacked
- How cost and time-saving solutions were reached

By **D. J. Wallace,** Vice President
Wheel Trueing Tool Company

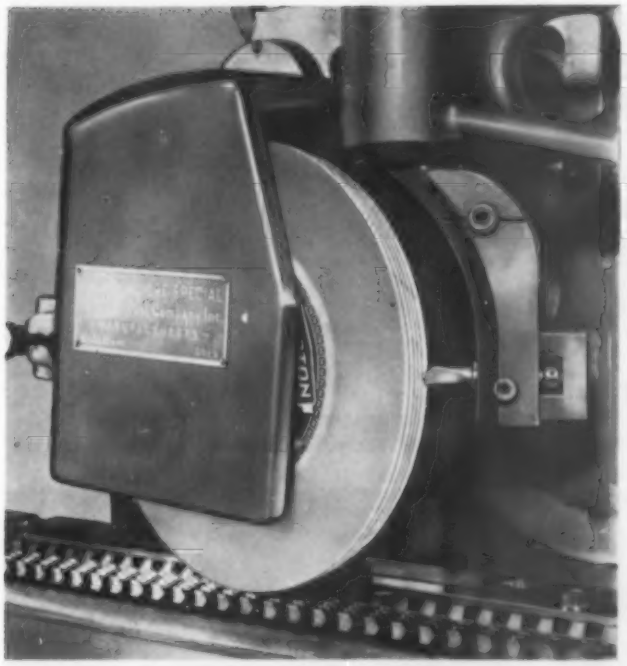


Fig. 1. Chisel-shaped tool dresses wheel in pine tree form for grinding broach inserts used to machine jet blades.

Fig. 2. Measuring tolerances of blade root profile between rolls at Michigan Broach and Tool plant in Detroit.

Fig. 3. Shadowgraph further checks profile of broach form.

● Grinding the "pine tree" form in broach inserts is an interesting operation at Michigan Broach Corporation in Detroit. The broach cuts the form for holding the blades in the rotor of a jet aircraft engine. A Moore pantograph dresser is used to form the wheel. The operator traces the metal pattern on the table with a follower and the action is transferred to the diamond tool. The reduction is 10 to 1 on the dresser.

In the closeup of this operation, figure 1, you can see the chisel-shaped diamond tool in position to dress the grinding wheel. The work piece is also visible on the grinder table. This is a 100 grain, H grade wheel, 7 x ½ x 1¼.

The broach insert is M-3 high speed steel, 64-66 Rockwell C. It contains 40 cutting teeth with 3 lobes per tooth. Tolerances per individual tooth and the cumulative total for the full length of the broach cannot exceed .0002 in. The tolerance variance must be equally divided on either side of the broach center line.

Since measurement of the profile is made between rolls, as illustrated in figure 2, the tolerances of this form cannot exceed a half tenth per face of each lobe.

The form itself is further checked by placing a

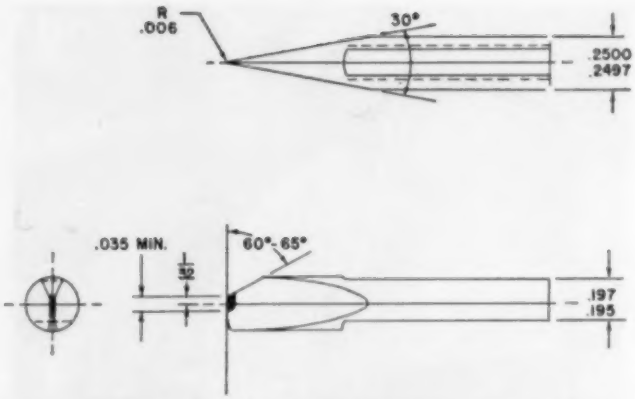


Fig. 4. Print of diamond radius tool used to form the "pine tree" wheel. Diamond has to be centered within .0002-in.

Fig. 5. Shadowgraphing a set diamond at 62½ times magnification to check qualification for lapping as form dressing diamond.

test coupon at the end of the broach. The coupon is removed periodically and checked on a Shadowgraph with 100x magnification, figure 3. This allows the form in the test piece to be visually compared with the blue print specifications.

Figure 4 is a print of the diamond radius tool used to form this wheel. It is quite a sharp tool, having a 30° included angle with a .006" radius at the tip. Since the pantograph arm does not permit movement of the diamond tool for centering, the specifications for this chisel-type radius tool require extreme care in centering the diamond in the tool shank within .0002" of holder centerline.

Experienced diamond setters accurately position the diamonds in the powdered metal matrix material, assuring maximum performance of the tools and maintenance of accurate form in the grinding wheel. The diamond setter notes the grain structure and shape of the diamond, selects the best face to present to the work, and carefully centers the diamond. The radius tool, with a 30° included angle, requires a very select diamond with a long, thin point. The base of the diamond is set in the shank, with the longest point utilized for the cutting edge.

After setting the diamond in the tool shank, it is shadowgraphed at 62½ times magnification to be sure the diamond has the correct shape for this particular radius. A shadow of the macle diamond, showing the thin view of the diamond, is cast on a visual comparator, as in figure 5. The diamond must touch the grid lines at the three points shown in the illustration to qualify for use within that classification.

After selecting the proper diamond for the tool, it is finished in the radius lapping department. The diamond cutter is assisted by a sliding guide mounted on the work table in front of the diamond wheel. This guide is set to produce the prescribed included angle for the finished tool. The diamond is inspected frequently on a visual comparator to check the progress in forming the radius.

Producing Wheel Forms

Another broach manufacturer, Ex-Cell-O Continental Division, working on a "pine tree" form similar to the one just described, uses a Diaform dresser to produce its wheel forms.

In figure 6 the grinding wheel is in position to back-off the cutting angle of the teeth. The broach insert is of the same high-speed steel, 64-66 Rockwell "C", as used at Michigan Broach.

A 1-⅛ x 1 x ½ wheel is used for this ticklish grinding operation. The wheel is 60 grain, M hardness with a vitrified bond. For this particular operation the Footburt-Hammond surface grinder uses a booster to obtain approximately 8,000 rpm spindle speed.

Normally the wheel dresser is removed from the work table in grinding. We left it on for these pictures so that you could see the details of the Diaform. Notice that the operator traces the master pattern on a vertically mounted dresser.

Figure 7 shows the reverse side of the machine, with the spindle positioned for dressing the wheel. Two diamond tools are used as you can see. The roughing diamond tool has a 40° included angle with .010" radius, with a .005" radius, 40° included angle diamond tool used for finishing the form. This broach maker finds that 2 to 3 dressings are required per side of each broach insert to maintain the close tolerances of the "pine tree" form.

Machining Roots of Blades

An interesting production grinding set-up which directly ties in with the broach manufacturing just described involves two different Ex-Cell-O grinders machining the roots of the blades and buckets that fit into these rotor slots.

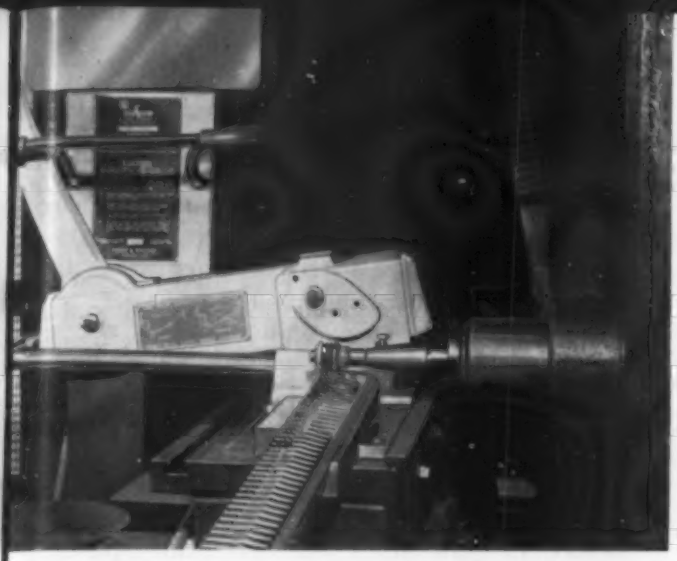


Fig. 6. Diaform dresser used at Ex-Cell-O Continental Division to produce wheel forms. 60 grain M hardness vitrified wheel is run at 8000 rpm on the Footburt-Hammond surface grinder for this operation. Dresser normally out of way.

Fig. 7. Reverse side of dressing machine, with spindle positioned for dressing. 2 to 3 dressings required for each insert.

A Style 85 two-wheel precision form grinder with the hoods raised and the protective covers removed is shown in figure 8. You can see the two horizontally mounted grinding wheels which simultaneously grind the two sides of the root to give it the "pine tree" form. Automatic wheel dressers are located at either side of the machine.

The blades are held in the fixture in figure 9 and automatically fed into the grinding wheels. Infeed of the grinding wheels is also automatic after each pass or alternate pass.

Twenty-four cuts are required to finish these roots in removing approximately .150" stock on each side. Nimonic No. 80A steel is used in the blades and buckets. The complete grinding cycle, from insertion of the blank work piece to removal of the ground blade, requires just 1 minute, 33 seconds.

At the front of the "85" grinder is another patented Wheel Trueing diamond tool that is making a major contribution to form grinding production efficiency. We call it a diamond grit block. It is used for rough forming new grinding wheels. We developed this diamond block in 1952 at the Ex-Cell-O main plant. It was first put into production on a jet aircraft engine job at General Electric's Evandale plant. They were using Ex-Cell-O "85" grinders and forming new wheels with lapped single-point diamond tools.

The old method required 4 to 8 hours to dress a pair of new wheels and completely consumed 6 to 8 single-point diamonds. These diamond tools cost approximately $14 apiece, a total tool cost of about $98 per set of grinding wheels. With this new diamond block, the two wheels can be "roughed-in" with the block and then finished with the machine's vertical cam type dressers, using formed diamonds, in just over 8 minutes! And there is no appreciable diamond consumption with this technique! One jet plant reports over 200 pairs of new wheels formed with a block and plenty of service left in the tool. Further, this method permits forming the wheels

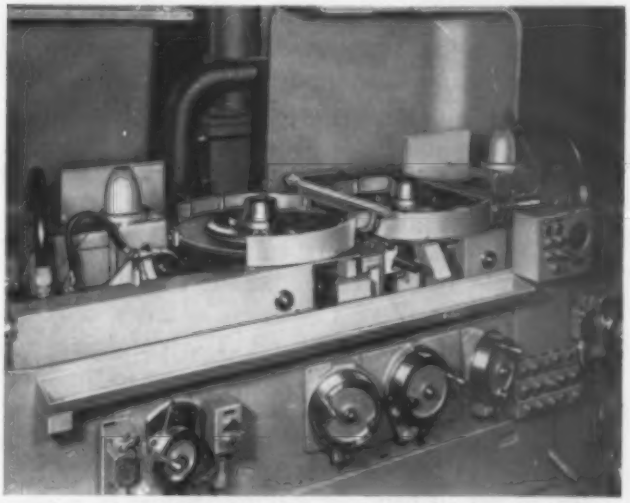


Fig. 8. Ex-Cell-O Model 85 two-wheel form grinder grinds blade and bucket roots. Dressers on either side of machine.

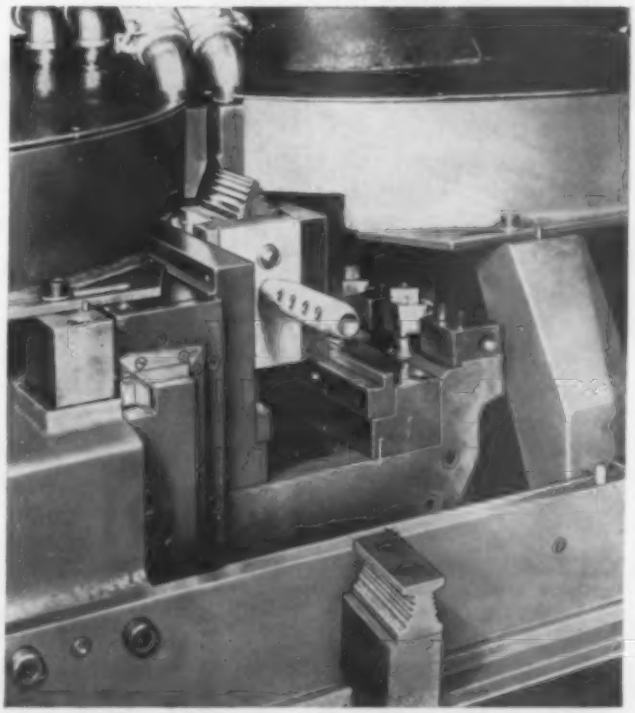


Fig. 9. Showing blade in position to be ground between twin wheels. Diamond grit block in foreground rough forms wheels.

on the machine itself, to give balanced wheels, ready to grind.

The entire surface of the diamond block is covered with thousands of individually hand-set diamonds to provide clean, fast cutting action. If you were to make a guess at the cost of this diamond tool, you'd probably be at least 100% high. Actually, it is the lowest cost tool available in production grinding, in terms of what the tool accomplishes.

Let's take a look at the figures for, say, three sets of wheels. The old method required 12 to 24 hours in down time to form three sets of wheels. The diamond form block takes only 24 minutes! The old method completely consumed $294.00 in single-point diamond tools in forming the three sets of wheels. The new diamond form block costs approximately $225.00 and many users report forming 50, 100—even 200 pairs of wheels.

A number of flat, grooved and curved forms are also used in finishing the roots of the various blade and bucket forms used today in jet engines.

Grinding 4 Diameters of Universal Joint "Spiders"

An unusual grinding operation at Ford is grinding all four diameters of universal joint "spiders" on a single, completely automatic machine.

A Landis No. 12 Centerless grinder does the automatic grinding operation. The magazine type feed provides a constant flow of parts to the work loader, where the spiders are positioned for grinding. An indexing unit turns the workpieces automatically during the cycle.

In figure 10 you can see the spiders in position to be ground. There are four grinding wheels on this machine, which partially grind two work pieces during each cycle. From .010" to .012" stock is removed from each diameter of the spiders at this station. The parts are hardened to 60 Rockwell C before grinding.

In the grinding cycle of the Landis machine, the work carrier, which positions the parts in the grinding fixture, transports two spiders at once. In this cycle, the rough piece is being ground at the first two diameters, while the second piece is being finished, figure 11. The wheel produces a radius at the shoulder as well as grinding the diameter of the shaft. At the end of this cycle, the carrier moves the spiders to a parts positioner where the finished piece is ejected.

The first part is then indexed to present the remaining two rough diameters to the grinding wheels. The part carrier then moves to the left to pick up a new rough part and position the partially ground spider for finishing. Each of these cycles requires 15 seconds, thus producing 240 finished workpieces per hour, at 100% efficiency.

Figure 12 illustrates a diamond blade-type tool that, so far as we know, is the first of its kind ever designed. You'll notice that the diamonds are exposed from the matrix at both sides as well as the top, or end, of the tool blade.

A group of select, long shaped diamonds are used here—all carefully watched for uniform size and structure. This is necessary, since the performance of the tool—and thus the tolerances of the grinder—depend completely upon even and uniform dressing. And, needless to say, it is also extremely important that the positioning of the diamonds in the matrix be very exact in order to achieve the uniform dressing action of such a tool.

The sketch in figure 13 shows why this unique diamond tool was designed with exposed diamonds at both sides and the end of the blade. Here are two hydraulically operated overhead wheel dressers on a No. 12 Landis—one between each set of grinding wheels, with the blades at right angles to the axis of the wheels.

The automatic dressing cycle is controlled by a workpiece counter, with automatic diamond feed down and compensation to the wheel base. Dressing requires 25 seconds. A hydraulic, counter type dresser moves the dressing tool across the grinding wheel face from the outside, toward the center and down the inside to form the radius. The cycle is then repeated on the other wheel. You can see, then,

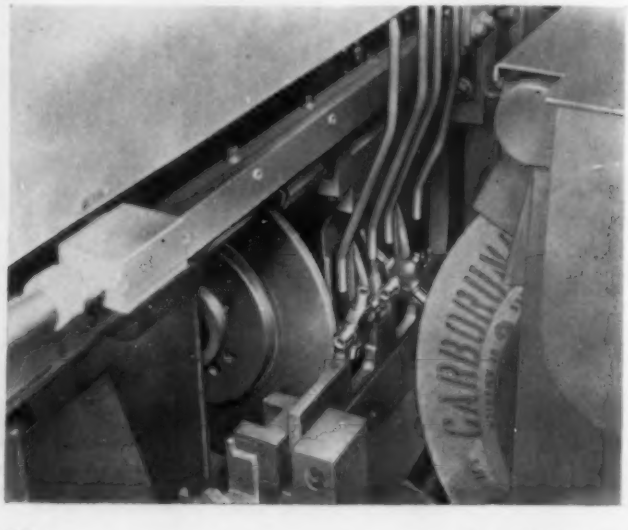


Fig. 10 Two universal joint spiders at a time are ground in Ford plant on Landis No. 12's, using formed wheels.

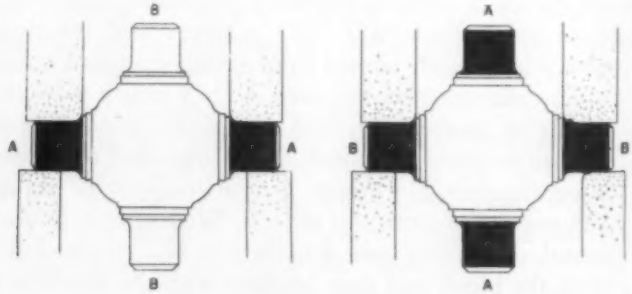


Fig. 11. Rough piece, left, is being ground at diameters "A," while second pair of wheels finish grinds diameters "B."

how each exposed surface of the diamond tool contributes to the wheel dressing.

The last two unusual jobs were worked out with Gear Grinding Machine Company, Detroit, Michigan. They both involve multiple gear grinding and each required some unique diamond tools.

The first part is a straight-sided external spline shaft, which controls the blade hub-assembly of a Hamilton propeller. There are 176 teeth to be ground on this shaft, which is hardened to 56-58 Rockwell "C". Approximately .050" stock is removed from each tooth which has a 30/60 diameter pitch with .010" radius root.

Tolerances in the finished part required that these teeth be ground, rather than machined any other way. Since grinding one tooth at a time was time-consuming and costly, Gear Grinding Machine Company conceived a plan of grinding portions of several teeth with each grinding stroke. In figure 14 you can see the grinding wheel in position, making the first cuts on a blank test piece. The actual shaft is 6" long.

Dressing a complicated wheel form such as this required some ingenious diamond tool designing to do the job economically. Approximately 5/16" of grinding wheel is removed at the small diameter of the wheel. The cost of a cam dresser to do the job would have been prohibitive and any other type of dresser would have slowed down production considerably. An automatic dressing cycle was needed to keep up production.

A diamond block, figure 15, composed of individual diamond tools, was engineered for this job. The diamond tools are staggered in this precision-ground block to form the teeth in the grinding wheel. The wheel passes completely over the block and back again rather than plunge dressing.

These seven tools form the roughing teeth that take relatively shallow cuts. The three diamond tools form the semi-finishing teeth, while the last three finishing teeth of the grinding wheel are formed with a Hoaglund dresser, which is mounted on the bed of the machine.

A rather interesting sidelight of this job is the system of supplying coolant on this Gear Grinding Machine model SF 10x24 (fully automated). The hose at the end of the wheel spindle supplies coolant to the hollow spindle under 30 pounds pressure. There are 12 spaces, with a number of cross holes, permitting the coolant to flow in and through the grinding wheel. It has been found that the wheel is kept much cooler with this system and a better workpiece finish produced. Moreover, it permits faster stock removal.

But let us return to the diamond tools. Even after designing the unusual dresser, the problem was not solved. The very long and sharp included angles required in these seven diamond tools indicated prohibitive tool costs, approximately $250 each for the 3 to 4 ct. diamonds necessary for the length of the required cutting edge.

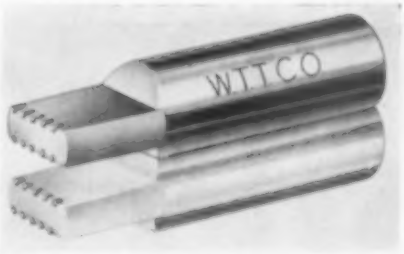


Fig. 12. Unique trueing tool developed for "spider" operation achieves uniform trueing action by careful diamond placing.

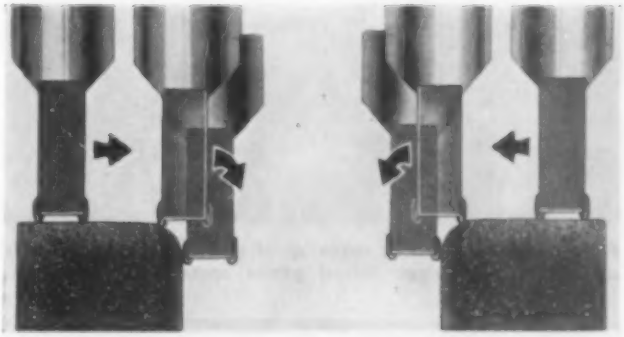


Fig. 13. Exposed diamonds at both sides and end of blade dresser makes possible special dressing stroke.

The sketch of the diamond grit tool we suggested, figure 16, tells the story. 3/16" of exposed cutting area is called for with a 60° included angle. The diamond impregnated tool provides much the same cutting action as the large single-point diamonds, at a cost of about $30 to $50 each for a tool saving of almost $1500 on this job.

Figure 17 gives you some details of the way multi-gear grinding is accomplished on this completely automatic machine. The first position indicates the condition in making the first cuts in a blank workpiece. Here the wheel is finishing the tooth form

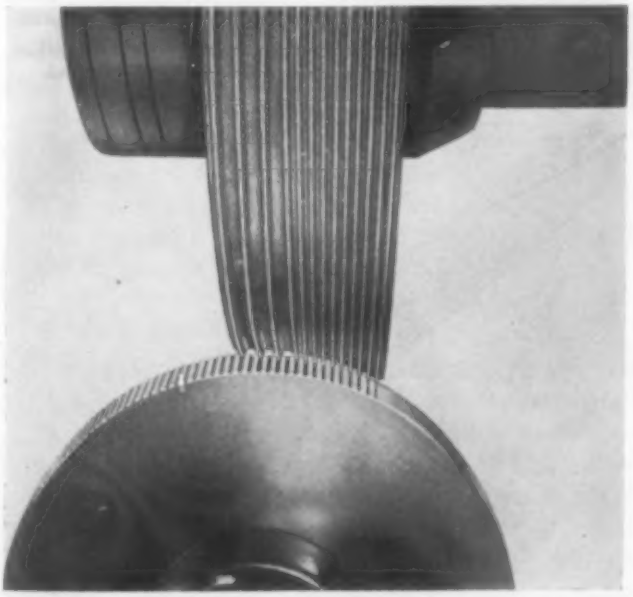


Fig. 14. Form wheel making first cuts on blank test piece. Actual shaft is 6 inches long. Note that first cuts are being made by right side of wheel, while finish splines are ground by portion of wheel to left, reducing operation time.

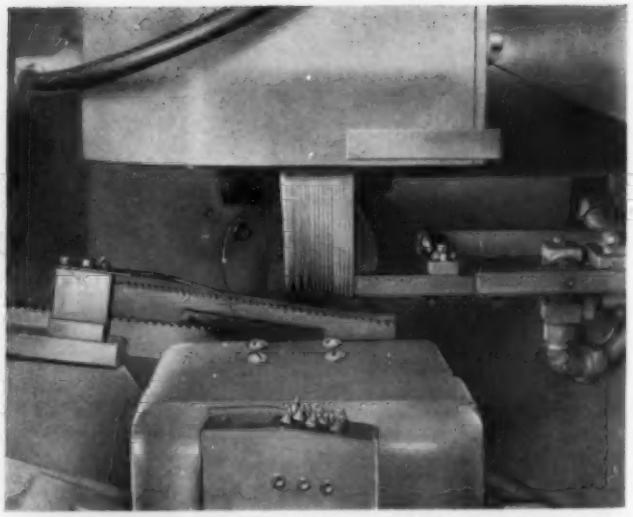


Fig. 15. Diamond block made up of individual diamond tools accomplishes dressing. Wheel passes completely over block.

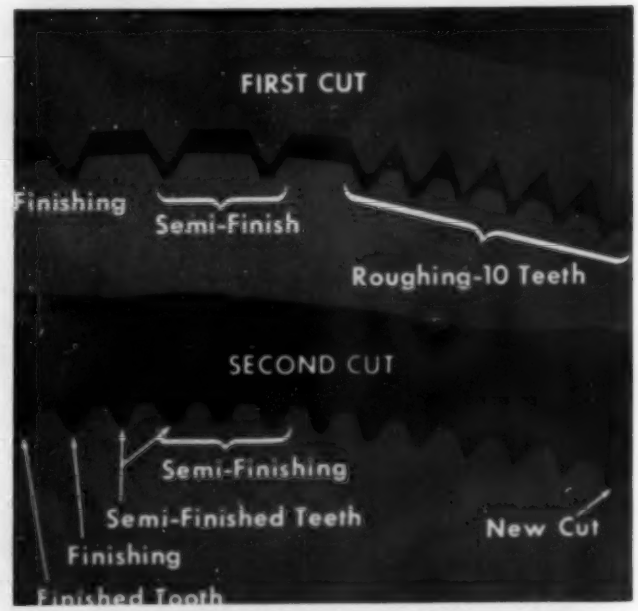


Fig. 17. On first cut, 10 teeth are roughed, two semi-finished, and one finished. Gear is indexed, more teeth are ground.

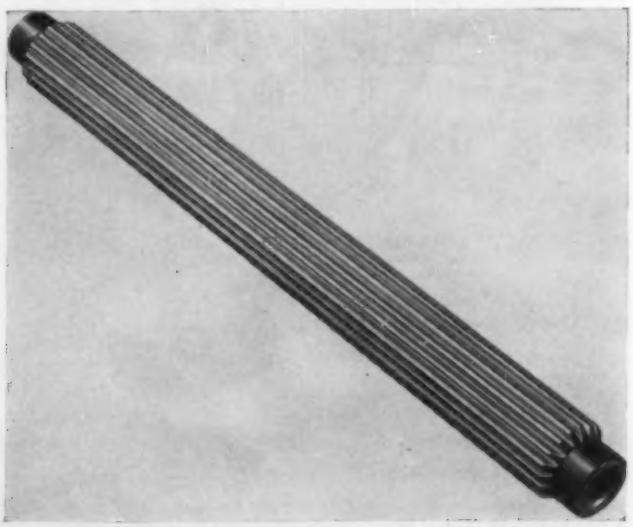


Fig. 18. 19-Flute, full-radius fillet textile roll. Teeth are first hobbed out, leaving stock on sides and root diameter.

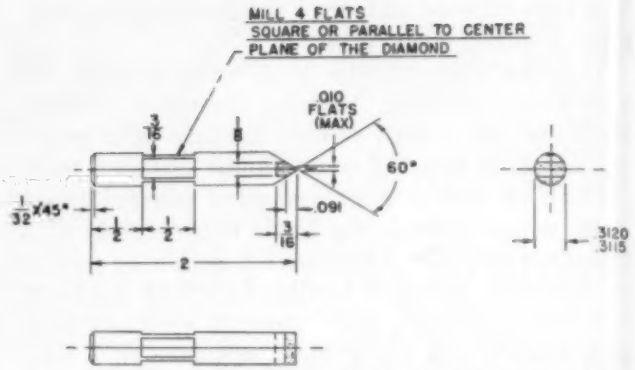


Fig. 16. Diamond impregnated tool provides much the same cutting action as solid diamond, saving about $1500 per tool.

and semi-finishing three teeth. The grinding wheel downfeed is therefore very gradual at first. At the same time, these ten tooth forms are being roughed out.

In the second cut sketch, you see the workpiece has been indexed one tooth form. Again the wheel downfeed is gradual to accommodate the finishing and semi-finishing grinding in blank stock.

On the next index, however, and all those following, the finishing tooth will be picking up semi-finished teeth forms and grinding speeds can be stepped up. Each new index position will then cut one additional rough tooth as you can see. With this technique a complete tooth form is finished in 18 strokes (or cuts) of the grinding wheel with wheel downfeed on each stroke. Approximately 24 wheel dressings are required per part. Production with the multi-ribbed grinding wheel is 1.9 pieces per hour, more than double the output of grinding one tooth form at a time.

Grinding Fillet Textile Rolls

A second job at Gear Grinding Machine is done on the same automatic grinder. It is grinding 19 flute, full radius fillet textile rolls. Figure 18 is a picture of the finished part showing you the tooth form of the 11 in. roll. The teeth are first hobbed out, leaving .004 in. to .007 in. stock on the sides and .004 in. to .012 in. stock on the root diameter.

Again, the part could be ground one tooth at a time but a quicker technique was wanted. After considerable engineering and several conferences with our company, it was decided that three flutes could be ground per index position.

The wheel form utilized and the diamond tools engineered to dress the wheel are shown in figure 19. A precision formed diamond grit block is used here to form the roughing ribs of the grinding wheel. Three individual diamond tools then finish the wheel surfaces which produce the flutes.

Finishing tool "C" in figure 20 is an innovation in a diamond tool. It contains a concave lapped diamond of approximately three-quarters carat. The diamond had to be hand lapped to the .043 in. radius

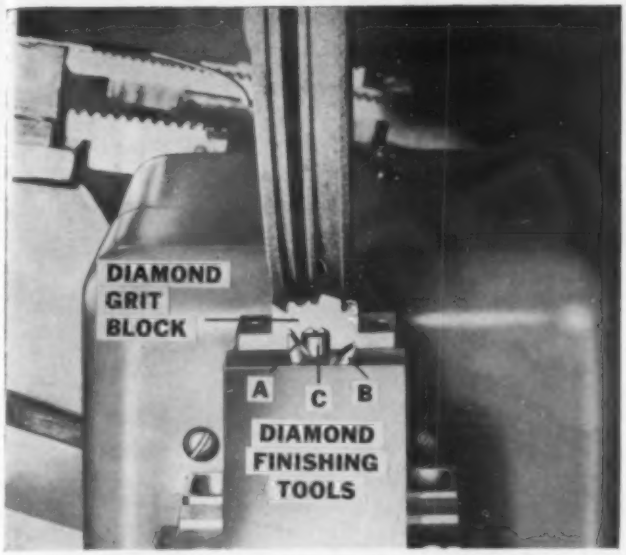


Fig. 19. Form utilized and diamond tools engineered to dress wheel for job. Three individual diamonds finish wheel.

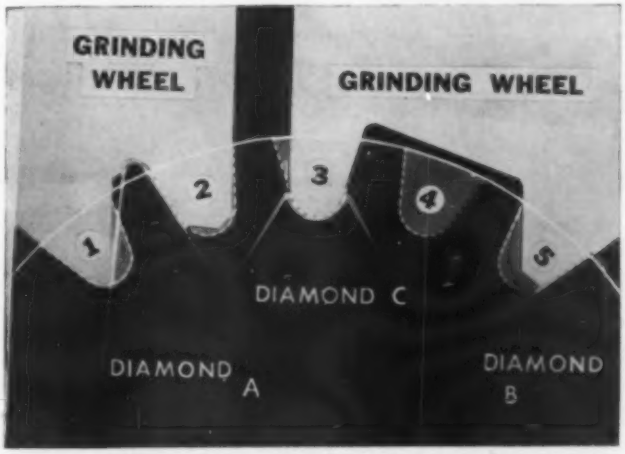


Fig. 21. Details of the multi-rib grinding operation, showing portions of wheel dressed by single-point diamonds. Part is indexed through positions 1 through 5 as it receives finish form. Diamond grit block rough-dresses wheel.

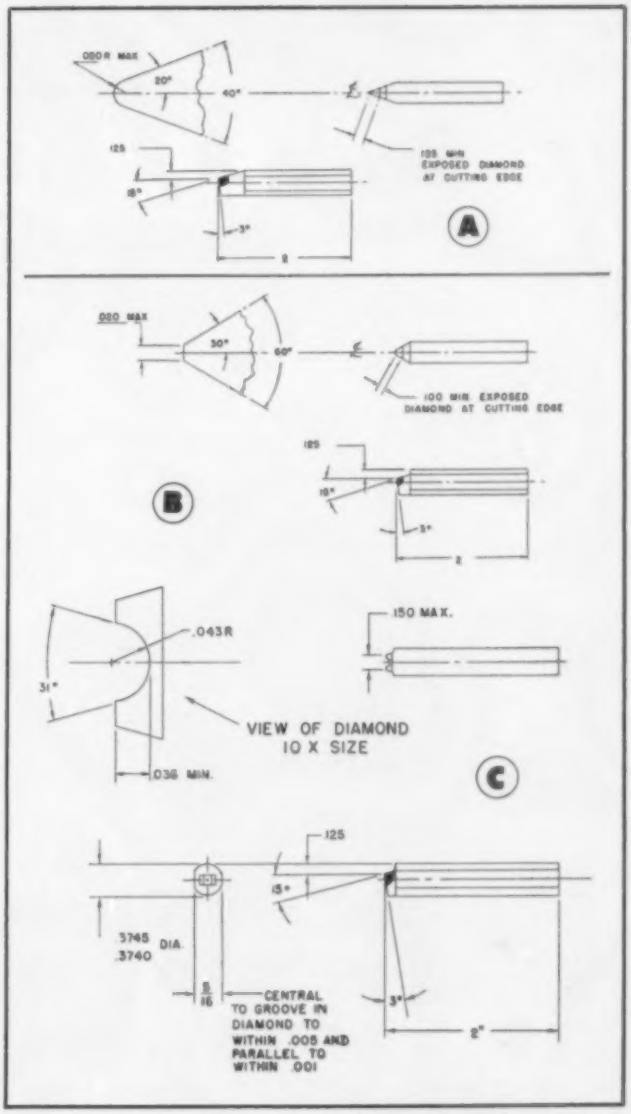


Fig. 20. Individual diamond tools designed for finishing wheel form. Tool "C" is unusual concave-lapped diamond.

with a minimum depth of .036 in. (point). You'll also note that 150 thousandths exposed diamond was necessary in the width of the diamond. But probably the most ticklish part of the job was the specification which required that the diamond groove be central to the tool shank within .005 in. and parallel within .001 in. The other two single-point diamond tools also posed some problems in the very sharp included angles of 40° and 60° with minimum exposed diamond areas of .100 in. and .125 in.

In figure 21 you can see the details of this rather fascinating multi-ribbed grinding. It is a composite illustration, showing a number of operations at one time. Two wheels are used on a single spindle. The diamond form block roughs out the grinding wheels. Next the grinding wheel passes over the three single diamond tools to give the wheel the finish surfaces.

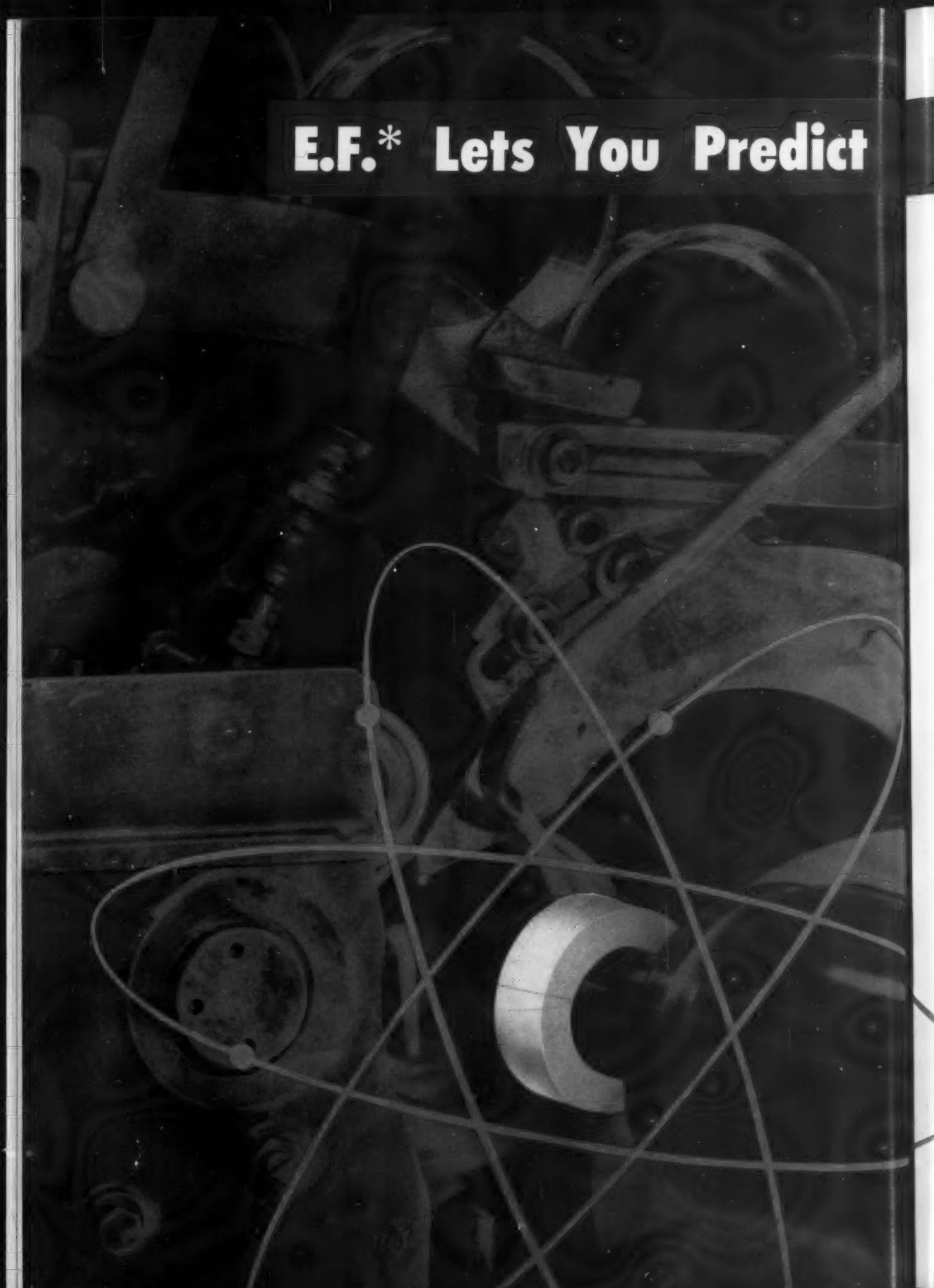
On this same sketch you can see the outline of the work part itself as the grinding wheel is making its passes.

At position one, the wheel roughs out some of the form. When indexed to the next station (tooth 2) the left shoulder is finished, by diamond A, while some additional root is roughed out by the block. In the third spot (3rd tooth) the root is finish ground by diamond C and the other shoulder is roughed. The tooth then skips one cycle (4th tooth) before the last step. Then, in this cycle, (5th tooth) the final shoulder is finished by diamond B.

9 Pieces Per Hour

Floor-to-floor production time for these pieces is 9 pieces per hour, a saving of approximately 60% in grinding time per piece compared to single tooth grinding. The grinding wheels are 38A703-K8V's and produce approximately 80 work pieces per set of wheels.

In actual production, optimum output was produced with 6 rough cuts of all the teeth and then another rotation of the piece to receive 2 finish cuts at each index. • • •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Tricky problem for Allis-Chalmers —

Form Grinding 1500 Jet Blades

A-C had to make sure the size, form and location of the grooves were perfect for proper fit of the blades in the rings of turbo-jet engine compressors. How did they do it? Grinders were equipped with pantograph-controlled form dressers.

By **J. L. Bryant,** Process Engineer
Allis-Chalmers Mfg. Company

● Allis-Chalmers' entrance into production of jet engine components in 1951 created many new problems for process engineers and tool application men. The project was the compressor for the Curtiss-Wright J-65 turbojet engine, in which the stator section is composed of a housing and 14 stages of blades and rings. The 1500-odd blades of each housing are aligned and held in their ring by a small v-shaped groove in the base of each blade.

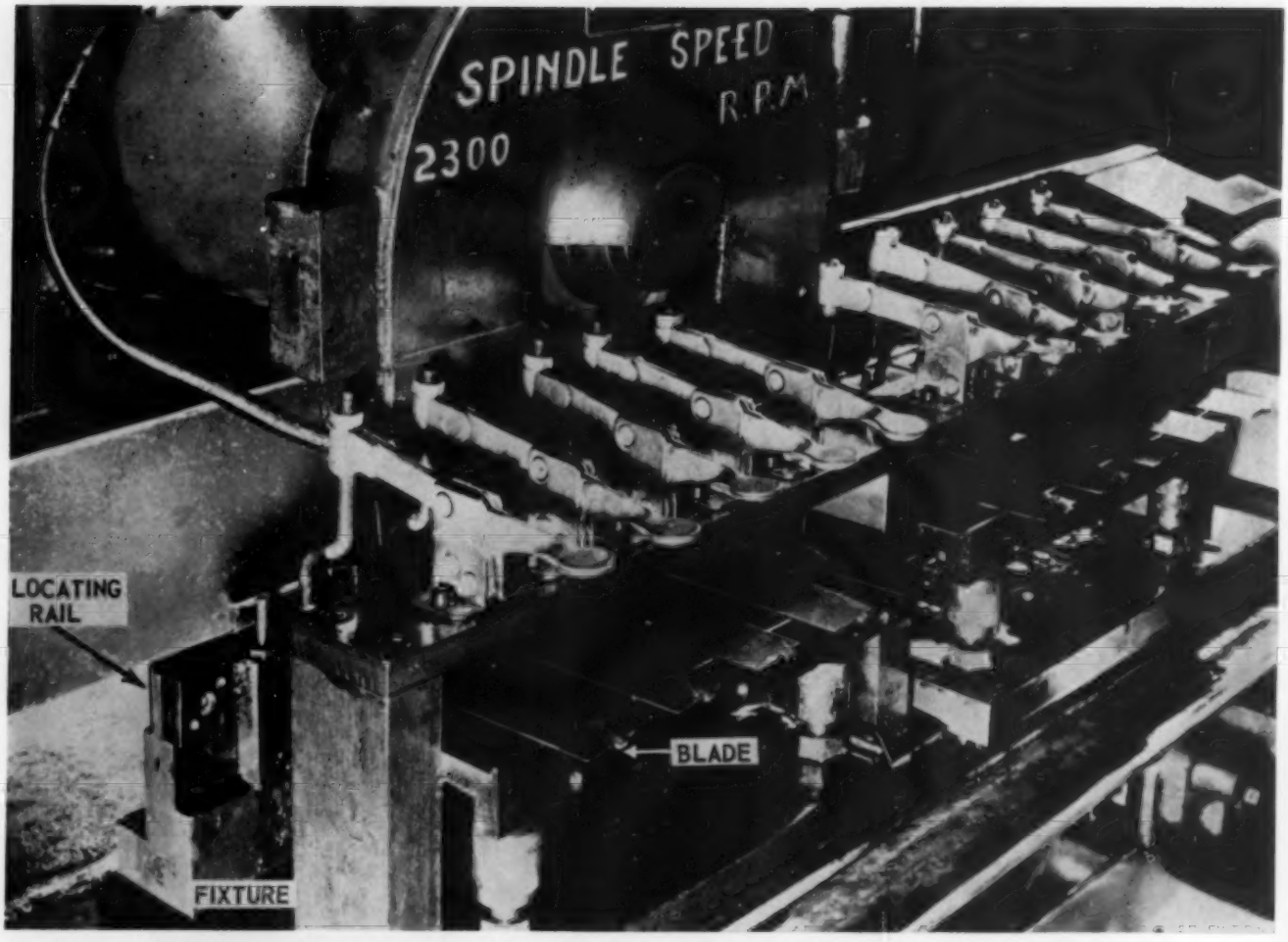
Size, form and location of the groove are of critical importance in alignment of the blades, since a slight error in root form is greatly multiplied at the blade tip. This is referred to as "lean." Excessive "lean" in either direction could allow interference between the stator blades and the blades of the compressor rotor. For example, on the 10th stage blade, if the form is off .001 in. at the root, there will be a lean of approximately .007 in. at the checking point. The profile form of the groove must be accurate within .0005 in. for the proper fit of the blades in the rings.

Consistently reproducing this blade root form in production quantities was a difficult task. And it was necessary to get into quantity production in a short period of time.

It was decided that the operation would be done on small surface grinders using precision form-dressed wheels to generate the groove profile. A fixture was developed for grinding ten parts at a time.

Location of the Blade

The fixture is designed to locate the blade on the pitch plane of the lower groove by means of a locat-



FIXTURE DEVELOPED for small surface grinder allows grinding of ten blades at a time.

ing rail with a .04697-in. radius while the top groove is being ground. In order to assure proper location for the blade, the fixture rail is ground to the proper radius with a wheel mounted on the grinder used for the grooving operation. This assures alignment between fixture and machine.

The grinders are equipped with vertical pantograph dressing attachments using a ten-to-one ratio between template and dressing diamond. The grinders must be very accurate and the spindles must run true. A warmup period of about two hours, allowing the machine to stabilize at normal operating temperature, is required before grinding can be accomplished satisfactorily.

A standard 10 x ⅜, 80 grit resinoid bond grinding wheel for the form grinding operation was selected after experimenting with several different wheels.

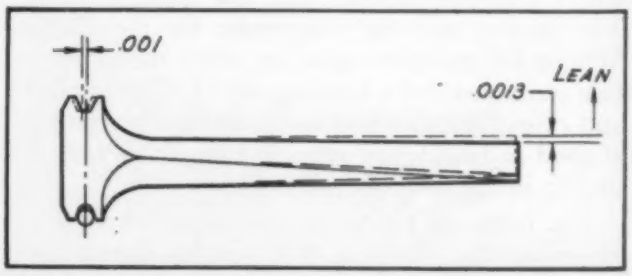
Excessive Diamond Usage

The company originally received diamond dressing tools with each dressing attachment. Later it was found that the tools supplied were not best for the form grinding operation we were doing, as indicated by the large quantity of diamond tools expended each month. Diamond life was frequently not sufficient to complete the form on one wheel. We found that a number of conditions contributed to the excessive diamond usage:

1. The design of the diamond tools was not suited perfectly for our operation.
2. We were changing diamonds indiscriminately.
3. We had insufficient control on diamond tools.
4. Diamond tools were being misused in dressing.

Problems Encountered

The first problem encountered was improper alignment between the flat on the dressing tool shank and the centerline of the diamond tip radius. If this were true, we found, the diamond would simply



MISALIGNMENT, OR "LEAN", of compressor blade due to improper location of mounting groove varies with length of blade and position of groove. Parts are located in fixture by placing lower guide on accurately radiused rail for form grinding operation on upper groove.

not be square with the wheel when mounted in the dressing attachment. This caused the back part of the diamond to drag against the wheel and ruin the form.

Another serious problem was encountered when the tools did not have a true .005 in. radius and the diamond edges were not smooth. Correcting these errors was necessary before the tool could be centered in the dressing attachment.

In placing the diamond tool in the dressing attachment, it is necessary to indicate the tip radius within .0002 in. Chipped edges or unsymmetrical mounting of the diamond in the holder give false indications.

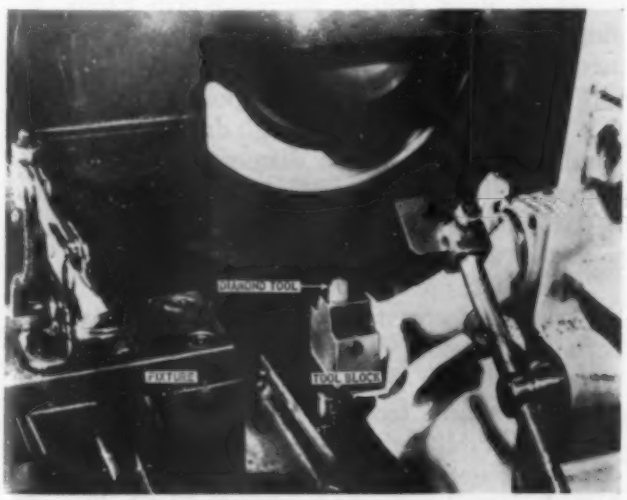
To arrive at better specifications for diamond dressing tools, Allis-Chalmers took into consideration the form to be ground, the type and size of wheel to be dressed and the accuracy and finish requirements of the part.

The diamond tool block holds the diamond at an angle of 5° in the direction of wheel rotation. This permits the use of both radii for the dressing operation, but both edges must be true and free of chips.

Experimenting with Different Included Angles

The physical size of the groove required an included angle of 40° or less on the diamond tip, but A-C experimented with 30°, 35° and 40° to determine the most satisfactory size. The smaller included angles did not produce as many dressings as the 40° tools, because of reduced diamond cross-sectional area. It was also found that the smaller angles tended to break loose from their mountings with lower pressure than was the case with the 40° included angle. But the 40° included angle was difficult to use because it allowed a small clearance between the included angle of the tool and the included angle of the work. So we concentrated on getting the operators trained to use extreme care in doing the manual dressing operation.

Allis-Chalmers engineers co-operated with the vendor in modifying the original design of the diamond



DIAMOND TOOL BLOCK positioned for form dressing operation.

OVERSIZE TEMPLATE for Dia-form pantograph controls dressing of groove in a 10-1 reduction ratio.

tools for the form-grinding operation. Each succeeding change, while of a minor nature, was a factor in reducing costs through increased tool life.

Lapping the small side faces of the diamond tip, considered necessary in the beginning of the program, proved to be so difficult that the shape of the tool and shank was modified to permit lapping to an accurate profile.

The simple procedure of rotating the diamond 180° to use both edges was not apparent in the early stages of the form grinding program. Consequently, we were getting only half the service we now get from the tools.

At the outset of the program each operator was made responsible for setting up and dressing his own wheel. He was also free to withdraw diamond tools from the crib. This was costly, because of insufficient care given the tools. Placing one man in charge of

AFTER DIAMOND IS LAPPED, it is rotated about its axis against indicator as shown. Pointer should remain on zero or show slight equal movement either side of zero if point is centered.

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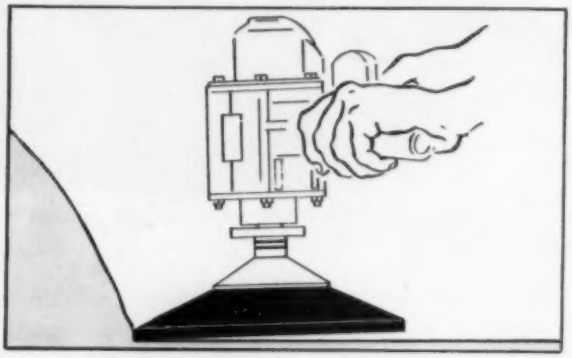

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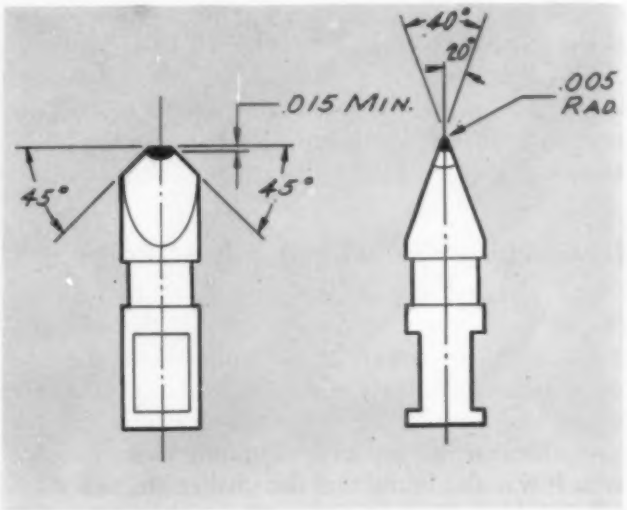
setting up and dressing the wheels resulted in improved life of diamond tools through consistent dressing procedures and proper use. Moreover, it placed on one man the responsibility of determining when a diamond was no longer usable and when it should be returned for relapping.

Common Misuses of Diamond Tools

Allis-Chalmers found the following to be the most common mis-uses of diamond tools:

1. Incorrect motion in dressing.
2. Using a .005 radius finish diamond for rough dressing.
3. Using too much feed while dressing.
4. Incorrect usage of coolant.

During the dressing operation, care is used to pull



DRESSING TOOL DESIGN evolved as Allis-Chalmers gained experience in form-grinding program. This is final design for jet compressor-blade operation.

the diamond across the wheel. The correct dressing motion never points the diamond into the wheel; this would result in serious damage to the wheel, chipping of the diamond, or possibly unseating the diamond from its mounting.

We rough-dress each wheel using a roughing diamond of about .020-in. radius. Worm finish diamonds no longer usable for finish dressing can be used to rough or semi-finish a wheel, but before doing this we consider the following points:

1. The time required for rough dressing a grinding wheel with a .005 radius diamond will be greater than with the roughing diamond. The time increase is compared with the time required for changing the setup to allow use of a roughing diamond.
2. The .005 radius diamond wears rapidly during the roughing operations. The diamond may wear beyond the point of salvage making it unfit for relapping.

It was found a feed of .0001 to .0002 and a speed of 2300 R.P.M. for semi-finish and finish dressing allows the optimum use of a diamond tool.

If the grinding is to be done with coolant, the

dressing is also done with coolant. There is always a copious flow of coolant on the diamond during the dressing cycle. Interrupted coolant flow on the diamond subjects the diamond to thermal shock, which causes serious damage to the diamond.

Checking Results

To assure the operator that the wheel has been correctly dressed, one blade is placed into the fixture and ground to size. The blade is then checked in an optical comparator. If the form is within the tolerance of .0005 of true form, the blade is placed in a gage to check for lean. This gage indicates whether or not the form is correctly located on the blade root. If both items check to print specifications, the operator proceeds to grind blades until the form obtained varies from the true form. Under normal operation, a properly dressed wheel produces good parts for a period of twelve to sixteen hours before it requires redressing.

Conclusion

Since the start of the program three years ago, Allis-Chalmers has reduced usage of diamond tools by approximately forty-five per cent. This was accomplished through proper training, improved design and improved control of diamond tools.

In conclusion, the important considerations we feel should be understood thoroughly by engineering, production and supervision in setting up a program of form grinding include the following:

1. Proper machines.
2. Correct wheel size and specifications.
3. Properly designed diamond tool and dressing attachment.
4. Adequately trained operators.
5. Close control of diamond tools.
6. Sufficient time to relap diamonds.

This article was abstracted from paper 24T15, presented at the 1956 ASTE Meeting in Chicago, Illinois, March 19-23. • • •

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This die-cast aluminum handle for furniture is one of several thousand processed each month by a Cincinnati, Ohio manufacturer. The handles must be given a super-smooth finish prior to plating—a job formerly done by rough finishing with a competitive barrel finishing abrasive, then *hand* buffing to produce the desired finish. The hand buffing cost was prohibitively high.

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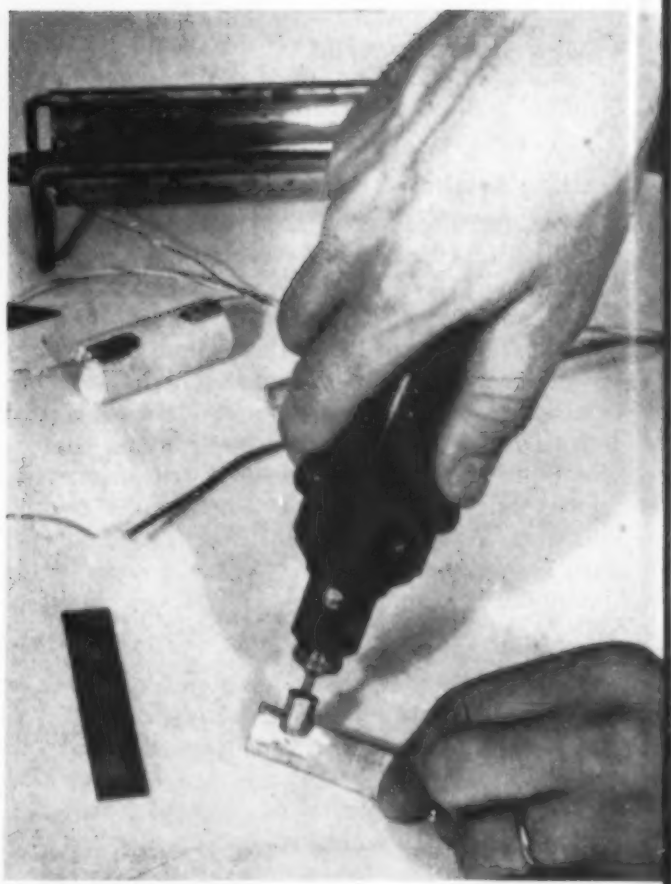
Solder Those "Unsolderable" Materials

. . . with a loaded grinding wheel on a small hand grinder

● An unusual new technique which permits soldering such materials as aluminum, stainless steel, glass, and ceramics, without special equipment has been developed by the University of California's Los Alamos Scientific Laboratory.

The new method of joining materials formerly believed impossible to solder, requires, in addition to the usual soldering materials, only a hand grinder with a mounted point type wheel. The technique was discovered during a research project on the use of ultra-high-frequency sound waves in soldering, and ironically involves doing something that apprentice mechanics are taught not to do.



NEW SOLDERING TECHNIQUE permits joining of glass, aluminum, stainless steel, and other materials, heretofore considered unsolderable.

Loading the Wheel

To solder these previously unsolderable materials, the grinder is turned on and the abrasive wheel (preferably preheated by grinding metal or the use of heat) is brought to bear on a soft solder such as Wood's metal or 60-40 lead-tin. The soft solder melts and flows onto the surface of the wheel, "loading" it and incidentally making it useless for its customary purpose until it has been dressed. The solder-loaded wheel is then applied to the surface to be soldered until a slight amount of abrasion has taken place, using the pressure one would ordinarily use in grinding. The heat of friction again melts the soft solder, which flows onto the freshly abraded surface and forms an excellent contact.

After this tinning operation, soldering is done in the usual manner with standard 50-50 lead-tin solder. The other surface is also given the new treatment if it is a material not ordinarily "wetted" by solder. No soldering flux, surface cleaning, or pretreatment is used.

When working with such materials as soft glass, Pyrex, and ceramics, the best tinning is accomplished with a mixture of Wood's metal and 50-50 indium-tin. However, when soldering glass to glass or ceramic to ceramic, it is necessary to use flame or furnace heating to get enough heat to the surfaces to be joined.

The two surfaces need not be of the same material: metals, soft glass, Pyrex, and ceramics may be soldered in any combination.

A medium grit mounted point, ¼ x ½ on a ⅛ inch diameter shaft, is used. Size is not critical, but a wheel of this kind seems best. Several wheel compositions have been tried; all seemed equally good.

Two types of grinders have been used: a standard Handy-Grinder and a Dumore with fixed motor and flexible shaft. The Handy-Grinder is operated at slightly reduced speed from a Variac at 80 to 100 volts. It is low powered, but reaches high speeds if allowed to run free. The Dumore is higher powered and lower in speed, but we have found it less easy to use in a confined space.

It will help if the grinder head is warmed up operating it in contact with a piece of metal or by direct application of heat. Tinning alloy is applied to the grinder in bar form. The warm grinder head and the heat of friction will deposit a liquid film of metal. If this process is repeated two or three times, a fairly heavy coat of tinning alloy is built up. There seems to be a definite "conditioning" period for a new grinder head. Once a good deposit is built up, it is very easy to renew the layer after each tinning use.

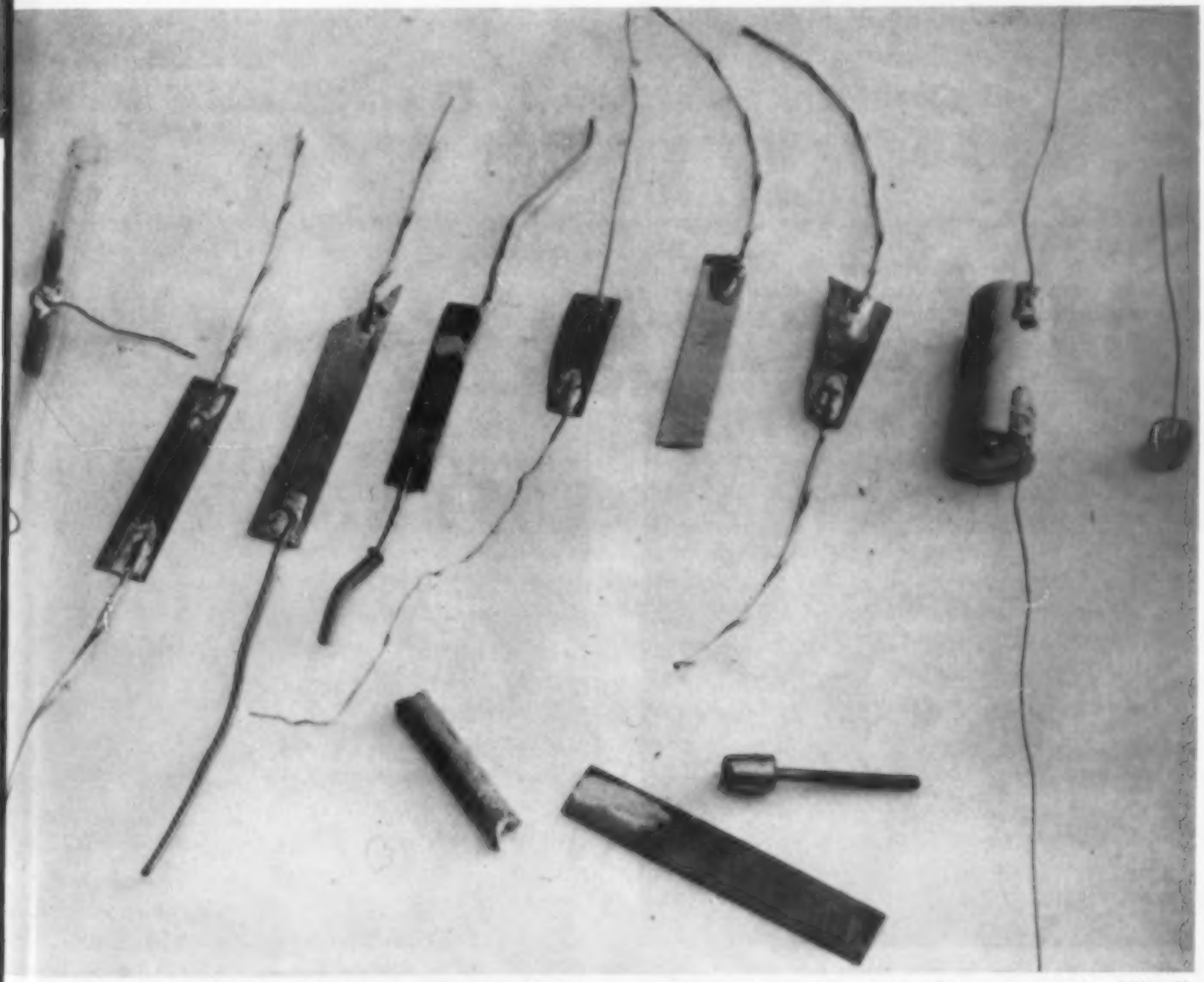
Applying the Wheel to the Work

Once a good deposit is held, the wheel is applied to the work with about the same pressure used in normal operation of such a device. When using the Handy-Grinder and Variac combination, the grinder will slow down. This gives a good limit to the pressure applied because if one presses too hard the grinder will stop. If possible, the work should be warmed, preferably to the melting temperature of the tinning alloy (about 80°C), particularly while the user is becoming accustomed to the process. This may be done by applying a hot soldering iron to the area. The grinder head is passed back and forth over the spot to be tinned. If one bears in mind that one is removing the oxide layer of the metal and replacing it with solder, one will operate the grinder accordingly. The tinning layer will be laid down as a shiny spot or strip and will have little ridges of excess alloy following the wheel as it moves. Incidentally, joints involving aluminum are particularly good for practice.

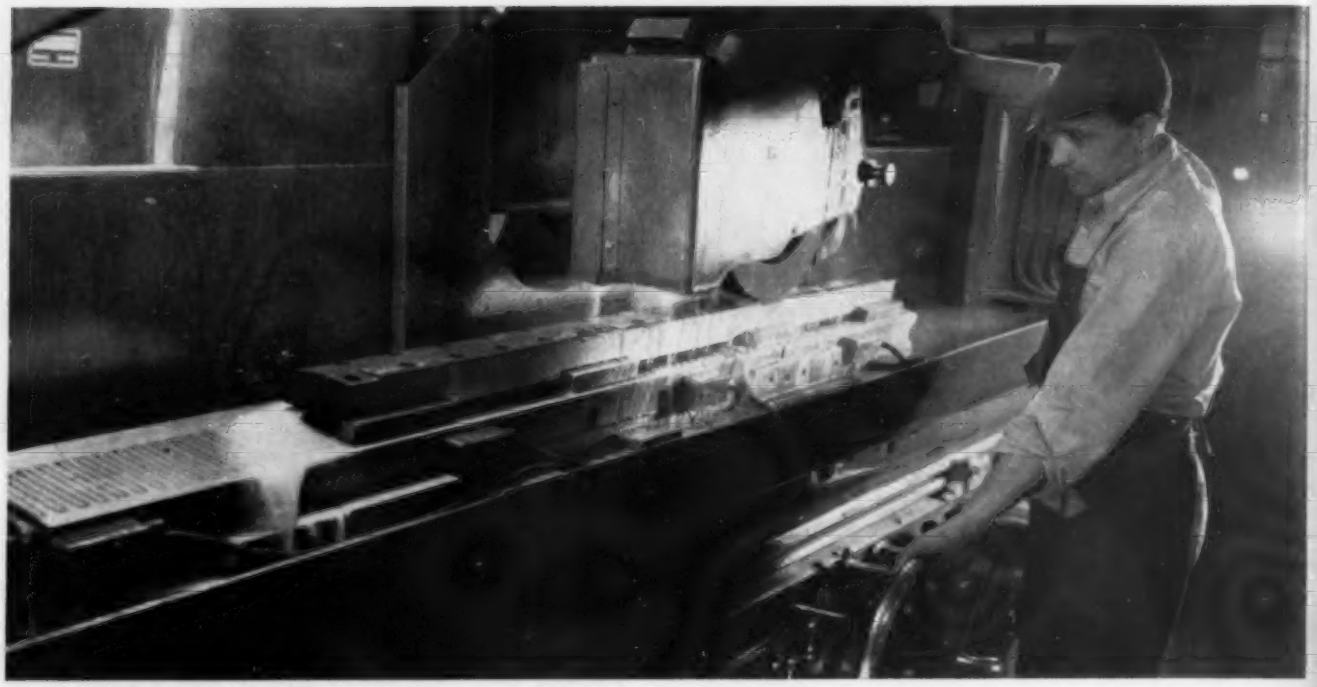
We have used many of the low-melting alloys ranging from 40° to 140°C in melting point, and all seem to work in the tinning operation. Solders used include 40-60 and 50-50 Pb-Sn, 50-50 Sn-In, and 50-50 Pb-In.

The 50-50 Sn-In may be applied very easily to Pyrex glass without the usual degreasing and heating cycles, and once applied will take the higher melting solders, for a surprisingly firm joint.

Ordinary solders probably cannot be used for the tinning operation on glass and ceramic materials. Wood's metal plus 50-50 indium-tin has been found best for this, with ordinary solder being used for the actual soldering. (Indium-tin alloy is known commercially as "Cerro-Seal," and is available from Sterling Products Co., 121 N. Jefferson Blvd., Chicago 6, Ill. or from Pick Steel Co., 4436 E. Long Beach Avenue, Los Angeles, California; names of other jobbers are available from Cerro de Pasco Copper Company of New York City. Wood's metal is available from scientific supply houses such as Central Scientific, Baker, Fisher, and Sargent.)



SAMPLES OF MATERIALS soldered by Los Alamos Scientific Laboratory's new technique: Upper row, left to right: Pyrex glass, titanium, molybdenum, aluminum, tantalum, stainless steel, tungsten, ceramic, cobalt; lower row: sample of Wood's metal, tinned stainless steel and "loaded" grinding wheel.

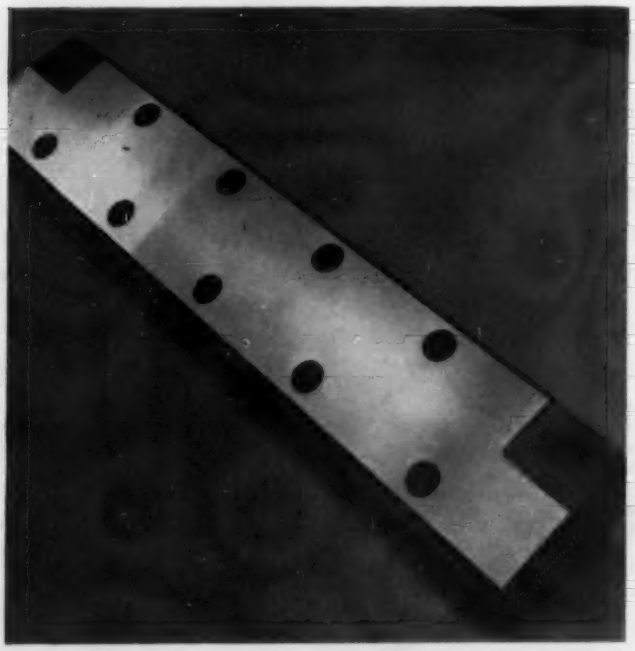


Overall view of production Mattison grinder engaged in grinding male toggle cam shoes at Lancaster. Photograph courtesy Mattison Machine Works, Rockford, Illinois.

Grinding Curved Surfaces on Toggle Cam Shoes

• The toggle cam shoes are made up in pairs, male and female. The smoother the curved surfaces obtained, the better they function in die casting machines where they are employed.

Such work is handled at the plant of Lancaster Machine Knife Works, Inc., Lancaster, N.Y., which makes various types of machine knives, shear blades, punches and dies, in addition to highly special and particular work like the toggle cam shoes mentioned. A Mattison horizontal surface grinder, equipped with a 168-inch chuck, is employed for grinding these shoes, which are made from Roloy No. 2 tool steel, with 63 Rockwell hardness. Both the contour required on the surface and



This illustration shows the male toggle cam shoe of a pair, with the curved surface, which is ground to 8 micro-finish at Lancaster Machine Knife Works, Inc., Lancaster, New York. Photograph courtesy Mattison Machine Works, Rockford, Ill.

Close-up view of Mattison horizontal grinder finishing the male curved surface of toggle cam shoes, two of which are positioned on the magnetic chuck. Photograph courtesy Mattison Machine Works, Rockford, Illinois.

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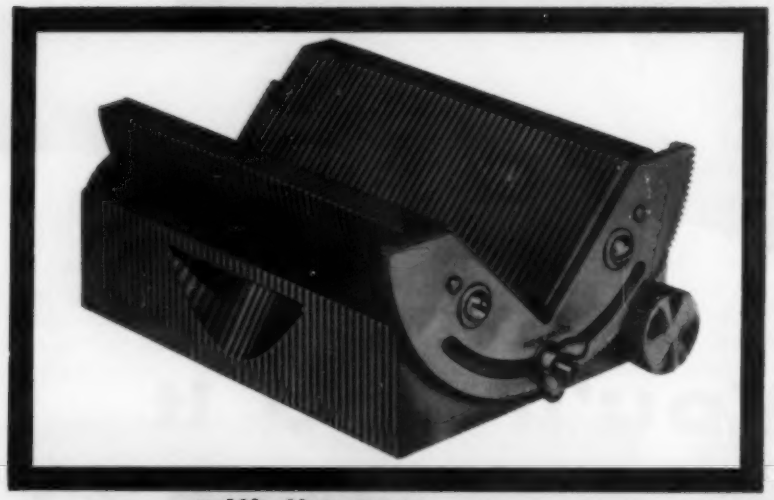
hardness of the material make the job difficult to grind from the ordinary standpoint.

On a large proportion of the work, the wheel has to be dressed several times an hour to insure quality work. However, in grinding the curved forms on these toggle cam shoes, a diamond dresser is set up on one end of the magnetic chuck, where it dresses the wheel to correspond to the required work form. While one end of the diamond dresser rides over the surface of a template, the other end dresses the wheel to produce the required contour.

Only two cam shoes are ground at one time. The shoes are placed on the chuck manually, and all sides with the exception of the curved one are ground flat. The curved side is given exceptional surface treatment, being ground to an 8 micro-finish. It must be accurate within plus .001" to minus zero. A 20-inch by 6-inch wheel is employed, of specification A80-18V. Wheel speed is 1150 rpm, and the table is traveled at 60 FPM. Codol is used as a coolant, mixed 1 part Codol to 150 parts water.

On jobs of this type, concave and convex curves can be ground with equal facility, one being no more difficult than the other. It is simply a matter of dressing the wheel face to the precise form required in each case. The point has been made that the particular job described is not a production job. It is a mass-production job in the indirect sense, however, since the parts ground are critical components of die casting machines used in mass production. • •

precision setup for precision grinding



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Pressure-

BEFORE—Brazed-up cutting tip before Pressure-Blast operation fails to disclose brazing cracks that may be present.

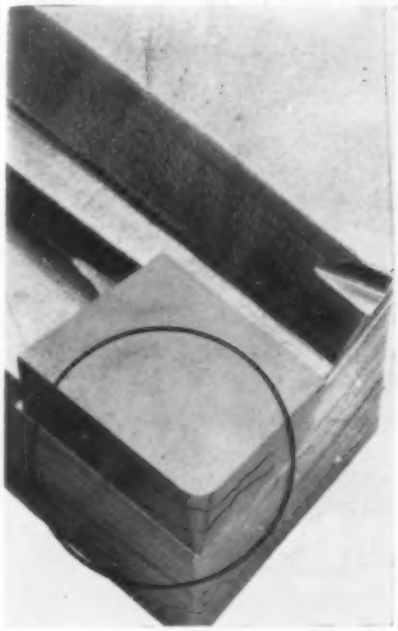
• Since the introduction of tungsten carbide, there has been a recognized need for some positive method of visual inspection for cracks, inclusions, and porosity. Such a method would present the possibility of annual savings of thousands of dollars in shops using a large number of carbide tools and cutters, this means not only new but also reground tools.

What about present methods for inspecting cracks? Acid-etching, electronic and dye checking, and other methods appear to be satisfactory only in extreme cases of cracking. They often show no indication whatever in known cases of cracking.

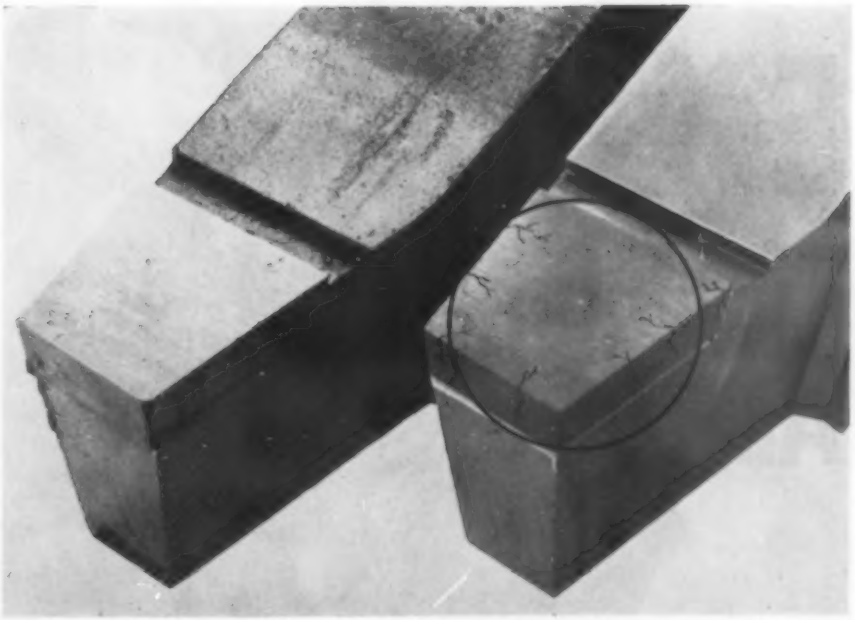
The Pressure-Blast method involves bombardment of the tool with a blast stream consisting of fine grit compound and water, with the addition of rust-inhibiting and anti-packing agents. This abrasive mass removes any metal, burrs or grinding scores without any apparent tendency to alter dimensional tolerances.

For toolroom use, the equipment involved in the use of Pressure-Blast is a small cabinet unit containing a hopper where mixing of the water-and-grit mixture takes place; plumbing lines of copper and high-pressure hosing for the transmission of free air and the abrasive-water mix; and operating controls. A manually operated blast gun is held by the operator, who inserts his arms through arm ports in front of the cabinet. In the case of small work such as single point tools

Blast Your Carbide Tools



AFTER—Pressure-Blast cleans out superficial grinding marks, effectively hones cutting edges, and reveals brazing cracks like the ones shown. (Retouched photo)



GRINDING CRACKS also show up much more readily after Pressure-Blast following tool regrinding. (View at right also retouched to show type of crack detected by the method.)

the work can be inserted through the arm holes; larger work can be admitted through loading doors in the ends of the cabinet. Work progress is observed by the operator through a large viewing window; the unit is equipped with a washing device which keeps the window clear for viewing the work.

Sizes and Types of Grit

Many sizes and types of grit are available for the pressure blast units. For toolroom applications, where the unit is to be used in preparing tools for inspection and for honing of the cutting edges, a 325 grit silica compound is used most often. In operation, the blast removes smear particles of cobalt binder which fill small grinding cracks, and also removes bond particles from the diamond tool-sharpening wheel. The edges of hairline cracks are also broken down slightly. The solution is forced into any cracks, and a finish ranging between 2 and 8 micro-inches is imparted to the blasted surfaces.

After blasting, the tools are washed off in running water and allowed to dry a few minutes. The solution, drawn to the surface by capillary action, is then readily visible to the unaided eye. Surface inclusions and improper bonding of tip to shank are also readily detected.

Tests seem to indicate the Pressure-Blast method effectively cleans out superficial grinding marks which would have no actual adverse effects on the use of a tool, but which might cause the tool to be discarded under ordinary inspection methods. The method also has the advantage of performing a honing operation as it prepares the tool surface for visual inspection. This has eliminated a hand-honing operation in many shops where Pressure-Blast is being employed.

Use in Research

The method has been very useful in research by companies using carbides into the causes of tool failures and has led to the elimination of these causes in shop practice. One large manufacturer reports that in one group of 100 similar tools purchased from a tool fabricator, one method indicated only eight cracked tools. In rechecking with the Pressure-Blast equipment, 32 tools were found to be cracked. In all, it was found that 30 to 35% of all tools purchased by this manufacturer were defective. This, of course, may not have been the fault of the tool fabricator, as their inspection equipment was probably at fault.

The same manufacturer investigated the large number of tools being classified as cracked in regrinding. Results of their tests, conducted by the Pressure Blast method, upon leaving the job and again after regrinding, showed that a large percentage of the damage could be traced to the job on which the tools were being used. This exonerated the tool grinding department, and the trouble could then be traced to bad practices on the job itself. The company conducting these tests has installed Pressure-Blast equipment with a muzzle velocity of 1700 feet per second, and with it they report that tools can be processed at the rate of one every 30 seconds. It has been found that an operator can check from 600 to 800 tools per 8-hour day.

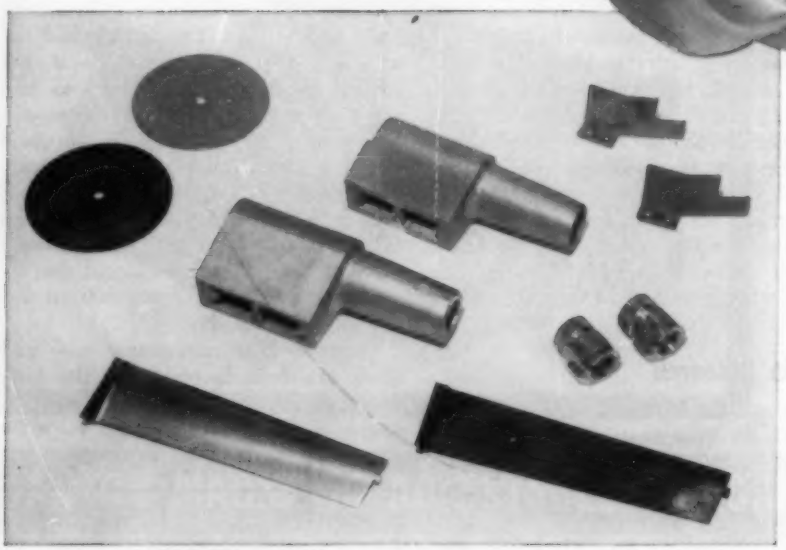
Pressure Blast equipment and supplies are manufactured by the Cro-Plate Company, Inc., of Hartford.

• • •

"He's got to do everything the hard way."

For Rapid Barrel Finishing

EXOLON Tumbling Abrasive



Various stamped, die cast, forged and screw machine parts before and after barrel finishing with EXOLON abrasives.

• More and more manufacturers are turning to barrel finishing for its big savings and uniformity over individual hand finishing.

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BOTH GOGGLES WITH FULL SIDE CUPS AND RESPIRATOR are used here by operator to remove rough spots from steel castings in rough grinding operation. Note also firm grip on grinder, with good balance to avoid chatter and prevent grinder from bouncing around. Note also that he grinds only on the surface of the wheel, avoiding both accidental side grinding or any cramping of the wheel in narrow grooves or openings in the casting. Both sudden pressures in side grinding or cramping and binding of the wheel in a narrow place can be a cause of sudden and dangerous wheel breakage.

GRINDING Safely

By **Edmund Mottershead,** President,

Mottershead Associates

Chicago, Ill.

● Portable grinding machines are extensively used in all metalworking industries, and a great many of these machines are designed to run at very high speeds, which requires the use of organic bonded high speed wheels.

Foundry wheels particularly are subjected to rapid wear, and as their size shrinks, their r.p.m. must increase. Thus they are almost always of organic bond, built to withstand shock and to be safely run at speeds in the 9500 s.f.p.m. range. It is particularly necessary to recognize this bond-speed relationship in plants where both types of wheels are used for various tasks. Both vitreous and organic bonded wheels are plainly marked, and should not be used on jobs for which they are unsuitable.

No attempt should be made to convert a low speed machine into a high speed machine without advice and possibly help from the manufacturer of the machine. Increasing the speed above its designed value by tinkering with the speed controls in order to use high speed wheels is a dangerous practice. The wheels are apt to break because of lack of rigidity, improper bearings, and the increased weight of high speed wheels. In addition, the protective guards may be of insufficient strength for high speed operation.

Wheels can also be broken due to inadequate power. If the wheel slows down materially when applied to the work with normal pressures, inadequate power is being transmitted to the wheel spindle. This may develop flat spots on the wheel, causing a bumping action which will result in wheel breakage. If adequate power is being fed to the wheel, and the machine then proves to be underpowered for the job, get a heavier machine. • • •

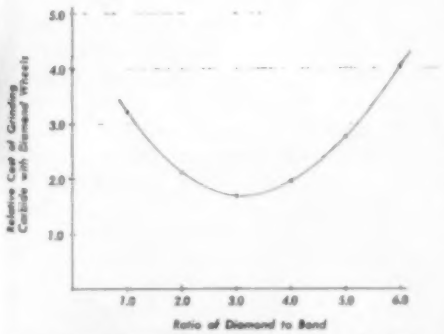
OBSERVING PROPER SAFETY PRECAUTIONS, this grinder operator is using a cup wheel pneumatic grinder with a hard wheel. Goggles, safety shoes, guard on wheel, and air hose carefully arranged to avoid tripping hazards, are included in his precautions.

Determining Diamond Concentration

in a Diamond Wheel

By **Frederick W. Lindblad**
President
United States Diamond Wheel Co.

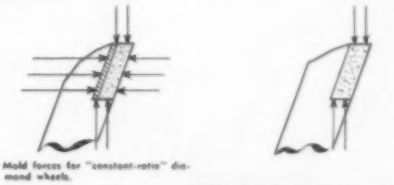
• For the past 20 years, since the first commercial mass production of diamond grinding wheels in 1935, an arbitrary figure representing diamond concentration in a diamond wheel has been used. This figure was used originally because it represented a relatively simple calculation in the manufacture of a wheel and fitted nicely into the economic structure of raw material prices and selling prices of the times. To say that present day technology has progressed from that of 1935 is to state a fact so empirical that it scarcely warrants the words to say it, yet there seems to be a trend to minimize the progress in diamond bonding technology and to restrain the use of new standards which have been developed for the grinding practices and the grades of cemented carbides and oxides used today.



1. How diamond-to-bond ratio affects carbide grinding costs.

In an effort to reduce the overall grinding cost of carbides, several ratios of diamond and bond were used in various wheels under the same operating conditions. It was found that very substantial cost reductions in difficult carbide broach and milling cutter grinding operations could be effected by very close control of the ratio of diamond and bond in a diamond wheel and not by the amount of diamond alone. This is shown graphically in figure 1. Since the fact was established that the ratio of diamond and bond were the determining factors in the cost of grinding carbides, it was found necessary to devise a method whereby all hardness grades of diamond wheels could be manufactured and still keep the ratio constant. In the summer of 1950, the author started work on a new method of bonding diamonds which accomplishes this purpose and this work resulted in a new diamond wheel which is fully covered and explained in U.S. Patent No. 2703437.

The first premise of the new method is that the ratio of diamond weight to bond weight in all hardness grades of a diamond wheel must be constant. Since the hardness of a diamond wheel bond is determined by the density of the bond, it would be impossible to maintain a constant concentration of diamond to bond weight if the volume of the diamond section remained constant. Under these conditions, if more



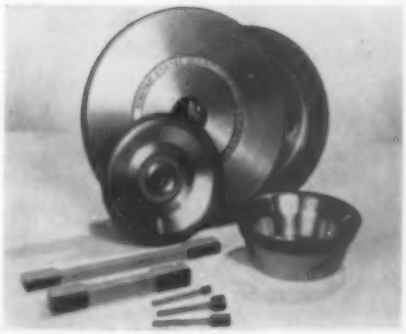
A. Mold forces for "constant-ratio" diamond wheels.

B. Mold forces for conventional ratio diamond wheels.

2. "Constant-ratio" diamond wheel has locking pressure in the bond around each diamond particle. Pressure is transmitted through core. This method holds the diamond more securely and gives longer diamond wheel life.

bond were added to increase the density, the ratio of diamond to bond would be less. If more diamond were added at this point, the cost of manufacture of an R grade wheel would be more than that of an N grade wheel. The new method of bonding uses a slightly variable volume of diamond section with the ratio of diamond to bond exactly the same at all times. The degree of hardness or density of the bond is exactly controlled by pressures applied in manufacture. As shown in Fig. 2, a true hydraulic pressure is developed in the mold and each diamond particle is completely encased in the bond. This requires the use of the flowable core described in the patent. The complete encasement of the diamond particle by pressure from all directions rather than in one plane only, holds the diamond more securely and makes a longer lasting diamond wheel. This method produces what is known in the industry as the "bonus edge", the small amount of oversize in the diamond section, i.e. a nominal ⅛ in. depth will be about .150 in. in an N grade to .130 in. in an R grade wheel.

The second premise of the new method is that controlled chip clearance space must be provided between the diamond particles to prevent loading of the wheel during the grinding operation. This is determined by the bond post length. The bond post length is the effective average distance between



3. Typical "constant-ratio" diamond wheels.

the diamond abrasive particles. It is a function of the diamond grit size and bond hardness yet with the new method of diamond bonding, the bond post length becomes longer as the grade is made softer so that the ratio of bond post length to hardness is constant. Again, it would be impossible to maintain a constant concentration of diamond in bond if the volume of the diamond section were held absolutely constant.

It has perhaps been that the efforts to accomplish these two requisites by other means have resulted in the confusion over diamond concentration which exists today.

The result of many years of experimentation and field testing of diamond wheels in conjunction with varying grinding conditions can be expressed in the following formula which gives a method for calculating the optimum diamond concentration in a diamond grinding wheel.

$$Dwt = \frac{Bwt \times .25S \times 5Dsp.gr.}{Bsp.gr.\ 1}$$

Dwt — Diamond weight in carats.
Bwt — Bond weight required for N grade.
Bsp.gr. — Specific gravity of bond used.
S — Average diamond particle size in microns.
L — Length of bond posts in microns.
Dsp.gr. — Specific gravity of diamond.

When the conditions as outlined above are translated into the manufacture of a grinding wheel, it will be found that diamond grinding costs will be materially reduced, the operators will be happier with a free cutting wheel and tools will come through the regrind with no damage and will give longer life on the machine. • • •

Shoulder Grinding

By **Christopher H. Hill, Sr.**

In precision cylindrical grinding of transmission gear shafts and other cylindrical work that the thrust face, or shoulder, has to be exactly square and 90° from the axis of the work being ground, if it is found that the machine will not function so that the shoulder comes square, there are several factors that will cause this trouble.

If the grinding machine is an old one that has seen much service it might be well to check the machine to see if it is exactly level. One of the worst mistakes made in some shops is to grout in the base of a machine with concrete. Most cylindrical grinding machines up to 96 inches between centers are made to rest on a three point suspension, longer machines being leveled by steel wedges built into the machine. The ones designed to rest on a three point suspension are erected, assembled and "scraped in" resting on these three points, and when put in use by the purchaser should be leveled by inserting steel shims under the pad, or pads, as the need might be. Never use wood or other flexible material as the weight of the machine will eventually compress the wood and leave the machine out of level. Sometimes when concrete is poured around the base of a machine with the mistaken thought that it will make it more solid, the concrete warps in drying and leaves the machine not level. Having places where the concrete does not touch causes vibration in the machine with the resultant chatters, these chatters being blamed on everything but the true cause. The best way is to take the recommendations of the machine tool builder. He will be pleased to give you the correct advice.

After a grinding machine has been used for a long period of time on short work without changing the position of the head and footstock, the baseways become worn within that area where they have been continually used, so that when the setup is changed over to accommodate longer work the pieces being ground will come large in the center. This is caused by the table dropping into the worn section of the baseways as it passes over it, the work being below the center of the grinding wheel. To prevent this trouble shift the head and footstock occasionally to different parts of the table.

It is the practice of most operators when changing over to work of a different length, to lengthen or shorten the distance between centers, to move the footstock only, this being the easiest way. This, of course, wears the base of the footstock, while the base of the headstock, not being moved, will not show wear, thus leaving the axes of the head and footstock out of plane. A grinding machine with the centers out-of-plane will not grind a square shoulder. To rescrape the bases of the head and footstock it is necessary to have a pair of special centers. These centers should have the correct taper to fit the center holes **correctly** and **accurately**, and instead of having the usual 60° point they should be ground square on the end. They should extend at least 6 inches from the head and footstock, the 6 inches being round and free from taper, and both should be **exactly** the same size. The bases should then be scraped until the two special centers, when brought together at any point on the table will show no appreciable error. This can be checked by a dial gage fastened to the wheel guard and moving the table back and forth checking both vertically and horizontally.

In squaring a shoulder the usual method followed is to true a recess on the side of the wheel next to the shoulder to be ground, so that only about ⅛ inch of the wheel will come in contact with the work. With a wider contact the wheel has a tendency to quickly glaze and burn the work. A still better method, which also reduces diamond costs, is to use a taper side wheel, say 2½ inches on the face, tapering down to 2 inches thick at the wheel sleeve. The wheel wears smaller in diameter at about the same ratio as the corner wears away, which keeps a sharp and clean cutting edge on the corner of the wheel being used to grind the shoulder.

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(Sliding guard removed, wheel guard raised, and coolant flow reduced.)

PHOTOGRAPHED AT COLE CARBIDE INDUSTRIES, ROYAL OAK, MICH.

CARBORUNDUM's Diamond Wheels are by far your best choice for grinding cemented carbide tools. On this rotary table surface grinder, a B7 Resinoid Bond Diamond Wheel permits maximum production rates without risk of checking or cracking the carbide . . . cuts exceptionally free and cool . . . requires less pressure between wheel and work to achieve accurate size control. CARBORUNDUM also produces a top-quality line of metal bond Diamond Wheels for offhand work and cutting off. Ask your CARBORUNDUM Distributor or salesman for your free copy of Form A-1208, an authoritative 40-page booklet on "Grinding Cemented Carbides". Or write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

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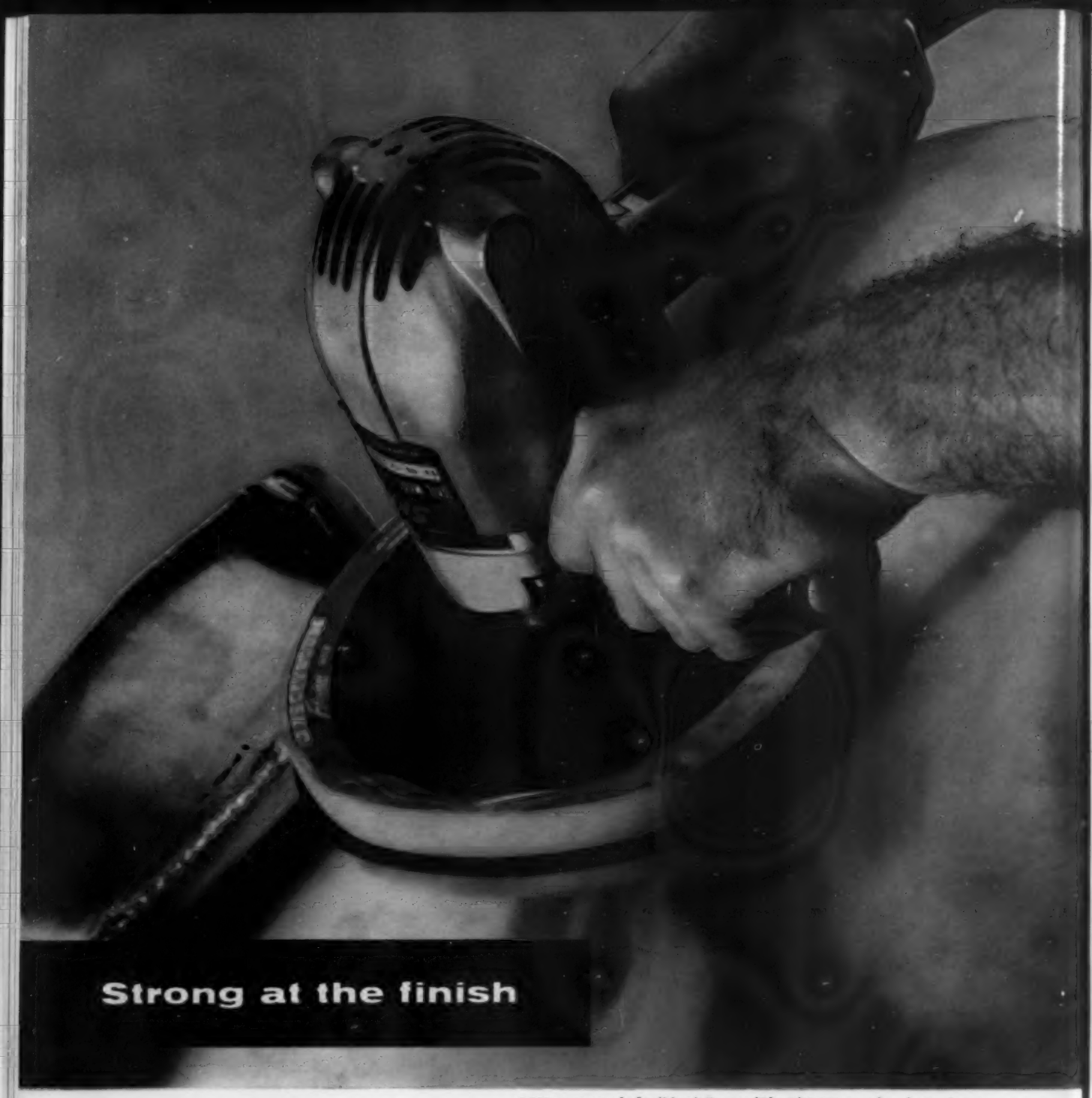

1,300-r.p.m. speed of polisher is "stopped" by 1/10,000-second stroboscopic exposure.

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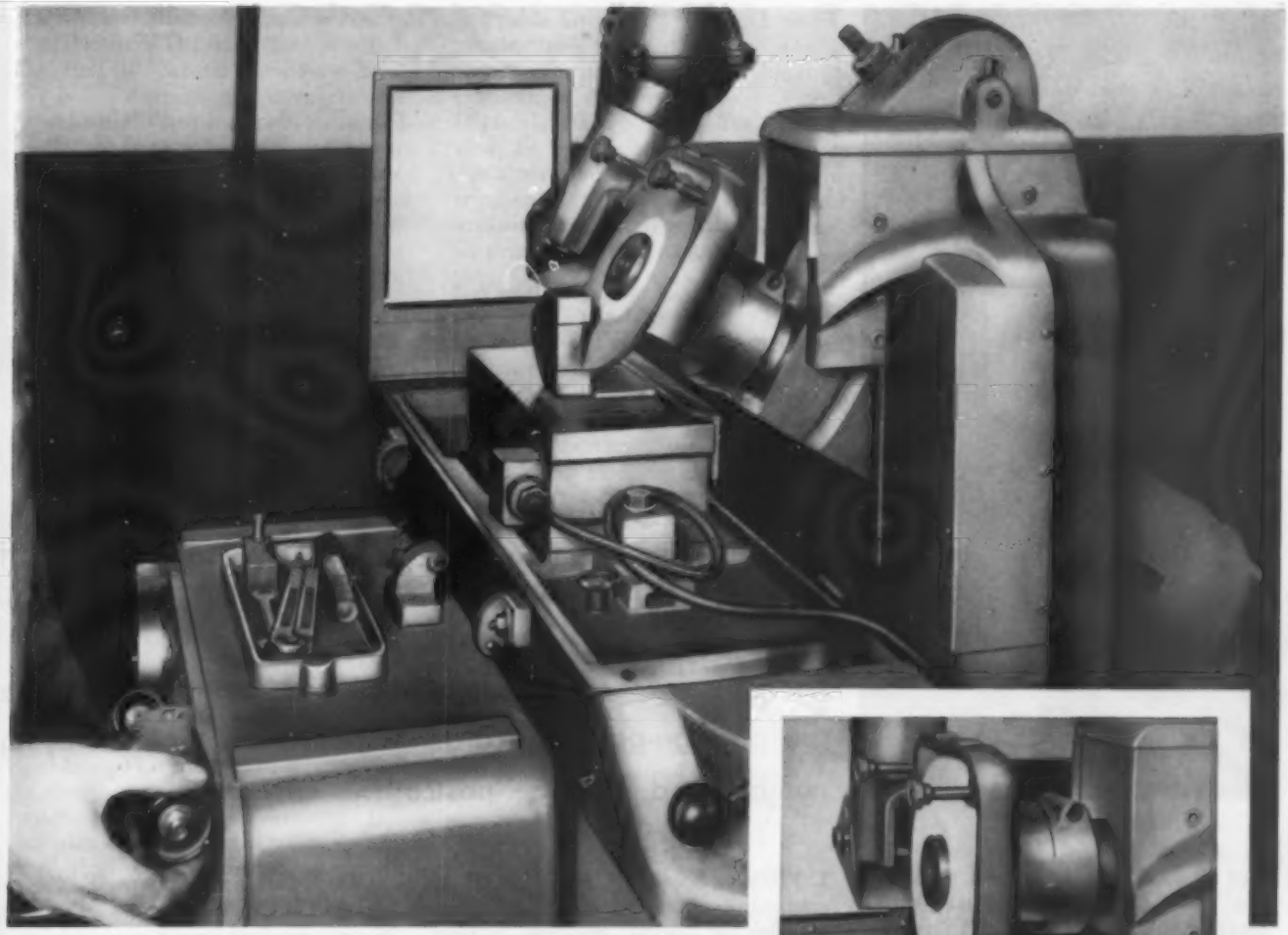
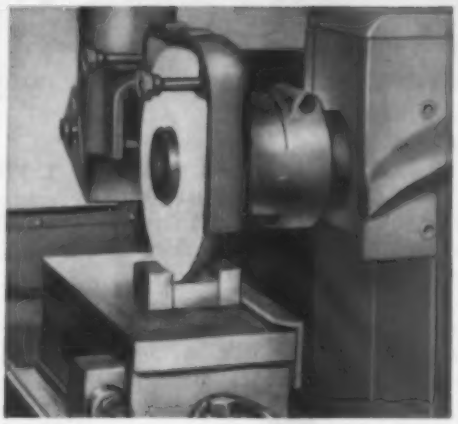
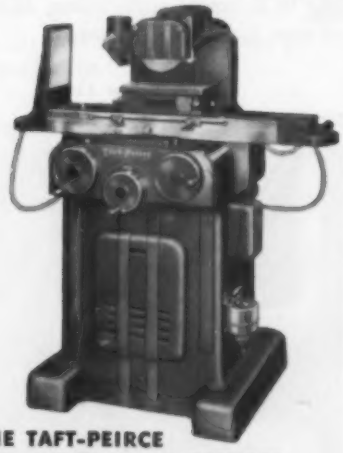


This is the new way — Taft-Peirce angular surface grinding, as compared to conventional side wheel grinding, at right. Workpiece is held on Superpower Electromagnetic Chuck with fine mesh face plate. (Wheelhead cover removed to demonstrate operation.)



T-P Tilting Wheelhead

Cuts Setup and Grinding Time in Half!



THE TAFT-PEIRCE NO. 1 PRECISION GRINDER

Tilting wheelhead is mounted between two pairs of circular dovetail slides, permitting swivelling of the entire spindle about the wheel center — through an arc from horizontal to 30° below center. Spindle can be set to any desired angle to simplify and even eliminate the setups frequently required for difficult grinding operations.

Same workpiece, same operation — but what a difference in time and cost.

Exclusive Taft-Peirce *angular surface grinding* makes it possible to complete a setup and grinding operation in less than half the time required with conventional side wheel grinding. Just set piece on magnetic chuck, dress wheel, and grind! And there's no problem with burrs, working over-size, curved surfacing, or wheel glazing.

All this, plus the extreme accuracy of the No. 1 Precision Surface Grinder. Operators easily grind to .0001", and to .00005", with experience. Surfaces are so smooth they seal without lapping; so accurate, they wring!

See these remarkable features demonstrated — we're sure you'll be convinced of the extra savings this grinder will produce. Contact your local T-P representative or write: Taft-Peirce Manufacturing Co., Woonsocket, R. I.

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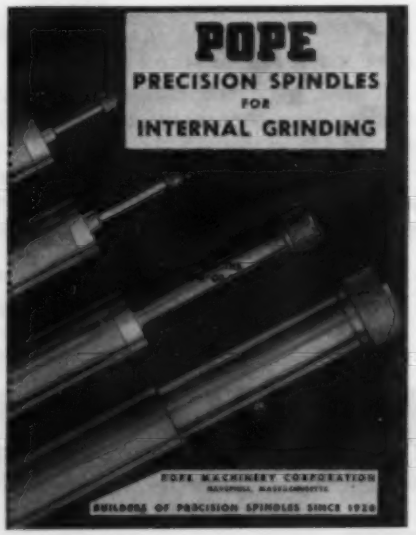
Available Literature

Catalogs and Bulletins Available from Manufacturers

For copies of the literature in which you have an interest use the postage-paid postcard. Merely circle the identifying number and mail the postcard.

1. Precision Spindles. Catalog No. 57-A, containing information on precision spindles for internal grinding, is now available from Pope Machinery Corp., Dept. GF, Haverhill, Mass. The complete line of grinding spindles is described and illustrated along with information on how to secure the right internal grinding spindle for the job. These spindles need never be retired, even after many years of continuous service, as the same specialized facilities that are used to manufacture new spindles, are available for the rebuilding of worn spindles.

(see Number 1.)



2. Metalworking Solutions. F. E. Anderson Oil Co., Inc., Dept. C, Portland, Conn., has just issued a new 16-page illustrated catalog covering the Lusol line of water based metalworking products for machining, grinding, rolling, drawing, forming and stamping. Catalog describes properties and uses of improved Lusol, K-7, Shamrock, Unikool, Machine Cleaner, G-3 germicide, rust preventive and water conditioners. Illustrations show these products working in different applications, and a list of case histories is included.

(see Number 2.)

3. **Diamond Products.** Catalog No. 5, available from Diamond Tool Research Co., Inc., 380 Second Ave., New York 10, N.Y., contains the complete line of industrial diamond products carried by the company along with a complete price list. Included are loose diamonds, dressers, powder, compound, etc. Also included in the catalog is a chart on the selection of the right diamond tool for the job.

4. **Portable Electric Tools.** A new universal electric tool catalog has been published by Thor Power Tool Co., Dept. FG, Aurora, Ill. The complete line of Silver Line and Speed Tool electric tools for use in the automotive, industrial construction, maintenance, trade crafts and home workshop fields, is illustrated and described.

5. **Mounted Wheel Safety Booklet.** The Grinding Wheel Institute has published a 36-page booklet that gives you information on maximum operating speeds for mounted wheels. Prior to this booklet, an operator was required to compute maximum operating speeds by using "critical speed" information. The eight easy-to-use maximum speed tables are designed to facilitate users correct application. They will eliminate the confusion which occurred when speeds other than safe maximum operating were listed. Write 2130 Keith Bldg., Cleveland 15, O.

6. **Surface Grinder.** Abrasive Machine Tool Co., Dept. RG, East Providence, R.I., has a new catalog available, giving a comprehensive description of its No. 1½ hand-feed precision surface grinder. Catalog shows how the No. 1½ grinds big tool room jobs, grinds flat every time and can grind deep with accuracy. New design features are the Electrabrasive stepless, variable speed spindle, the Dustsnaire filterless dust exhauster and the Abrasive wet grinding attachment.

(see Number 3.)

7. **Profile Grinder.** The No. 1 profile grinder with new improved design is described and illustrated in literature available from Boyar-Schultz Corp., Dept. G, 2000 S. 25th Ave., Broadview, Ill. This is a fast operating, precision machine tool, for saving time in grinding difficult contours, odd and irregular shaped and profiles, and similar time consuming jobs.

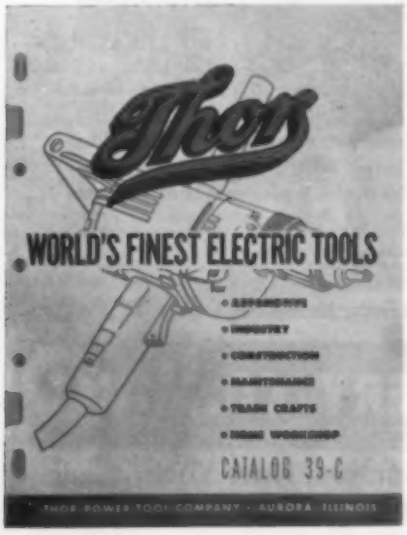
8. **Visual Grinding.** Literature is available from The Cleveland Grinding Machine Co., Dept. RG, Cleveland 12, O., describing and illustrating their Visual Grind machine, the projection grinder for infinite precision with continuous inspection. This machine was developed to meet the demand for accurate surface form grinding in both large and small tool room operations.

9. **Lapping Machines.** The Lapmaster Div. of Crane Packing Co., Dept. FF, 6404 Oakton St., Morton Grove, Ill., has literature available describing and illustrating their line of lapping machines and accessories. These Lapmasters readily lap flat to the extremely close tolerance of one light band (.0000116") or less, and in addition obtain a finish to as low as 1 RMS (microinch).

10. **Jig Borer and Grinder.** Columbia International Corp., Dept. GF, 10-35 44th Dr., Long Island City 1, N.Y., has literature available describing and illustrating the Burkhardt HYOP 54 co-ordinate jig boring and grinding machine. Machine has hydraulic movement of the table and the boring slide. Infinitely variable hydraulic feeds and automatic turning of the boring slide for grinding and honing. Accuracy of adjustment is .00005 inches.

11. **Abrasive Belt Machine.** Curtis Machine Corp., a subsidiary of The Carborundum Co., Dept. GR, 1300 E.

(see Number 4.)



(see Number 5.)

Second St., Jamestown, N.Y., has literature available describing and illustrating their new Model DBA-1F Flex-A-Belt machine. This two-spindle machine has a direct contact wheel for grinding, polishing and deburring, and fast interchange from platen to formed belt grinding, along with many other new features.

12. **Dual Action Sander.** Literature describing and illustrating the new Easy dual action sander is available from Detroit Surfacing Machine Co., Dept. FG, 1333 E. Eight Mile Rd., Detroit 20, Mich. This new dual sanding action moves in two directions at the same time. It turns 6000 rpm's to the right, and at the same time moves in a fast reverse action to the left. This two way action retards loading of abrasive even on surfacer, solder or decals.

13. **Hand Files.** A new fully illustrated brochure showing the use of Swiss precision hand files on the production line has just been published by Grobet File

(see Number 6.)

Co. of America, Inc., Dept. GG, Carlstadt, N.J. Bulletin 356 includes photographs taken at the plant of Underwood Corp. to illustrate the techniques of many hand filing operations necessary to insure the accuracy of small parts.

14. Wheel Dressers. Literature is available showing the complete line of hydraulic and manually operated wheel dressers, from Hoglund Engineering & Mfg. Co., Inc., Dept. GF, 343 Snyder Ave., Berkeley Heights, N.J. Specifications, construction details, and standard equipment are given for all models.

15. Flexible Shaft Equipment. Literature describing and illustrating the complete line of flexible shaft equipment, attachments and accessories is available from R. G. Haskins Co., Dept. RR, 2651 W. Harrison St., Chicago 12, Ill. These machines are designed for sanding, grinding, rotary filing, rubbing, polishing and wire brushing.

16. Filters. A new bulletin on the filtration of quenching oils has been released by Industrial Filtration Co., Dept. QO-478, Lebanon, Ind. The brochure discusses the changes in quenching oils which occur when the oil is subjected to repeated quenching operations. These changes which affect the efficiency of the quenching oils result in reduced operating efficiency and uneven quenches.

17. Optical Projection Equipment. Literature describing and illustrating the Model TC-14 and the Model FC-14, 14″ screen comparators is now available from Jones & Lamson Machine Co., Dept. RR, Springfield, Vt. J & L's Telecentric optical system gives you extremely accurate and sharp shadow images at all magnifications with controlled depth of focus. These images from which accurate measurements to .0001″ can be taken, are always erect and in black and white contrast.

18. Diamond Wheel Dresser. Koebel Diamond Tool Co., Dept. FF, 9456 Grinnell, Detroit 13, Mich., has literature available illustrating and describing their hand operated diamond tool indexing device for the cylindrical grinder. The Handexer makes possible the rotation of the tool on a definite schedule with merely a twist of the wrist, producing a series of tiny flats on the diamond. Bordering each of these facets is a corner, ready for a good sharp dressing the next time around.

19. Grinders. K. O. Lee Co., Dept. RG, Aberdeen, South Dakota, has literature available describing and illustrating their Model BA860 universal grinder; the Model BA800 tool and cutter grinder; Model BA803 chip breaker grinder; and the Model BA804 Carbide Tool Grinder. Design features and complete specifications are given for each machine along with attachments and accessories.

20. Measuring Surface Roughness. Micrometrical Mfg. Co., Dept. G, 345 S. Main St., Ann Arbor, Mich., has literature available describing the Profilometer Group 11—a versatile, portable equipment combination for measuring surface roughness in the shop. The equipment includes an Amplimeter, a type LJ tracer, and a Mototrace for mechanical operation of the Tracer. This equipment is said to measure more than 85% of all the varied surfaces produced by industry.

21. Gear Deburring. Bulletin 103-81, available from Modern Industrial Engineering Co., Dept. F, 14230 Birwood Ave., Detroit 38, Mich., describes the Burr-Master deburring and chamfering machine for internal gears and splines. Internal splines, straight-sided or involute-form helical and spur gears from ⅜″ to 3½″ pitch diameter are deburred and chamfered at production rates on the model BMI-14 universal internal Burr-Master.

22. Form Dresser. Monray Corp., Dept. FG, 24619 W. Warren, Dearborn, Mich., has literature available describing and illustrating the Zenith form dresser for accurate wheel dressing of any combination of radii and angles. Outstanding design and construction features along with complete specifications are included in the bulletin.

23. Infeed Grinding Attachment. Literature showing how you can boost centerless grinding production with Feedci-

Stone M-35A

cuts faster, cleaner, at lower cost

than any machine of its type!

Capacity: Ferrous 1½″ Solids, 2½″ Standard Pipe and 2½″ Structurals. Non-Ferrous, 2½″ Solids, 3″ Tubing and Extrusions.

Model M-35A
12″ Cut-Off Machine

The Stone M-35A cuts with a milled finish to a tolerance of ±.005″ any degree up to and including 45°—either direction. Positive geared-in-head drive, a Stone exclusive, delivers *complete* power to the cutting wheel. Cuts ferrous and non-ferrous solids at the rate of less than 4 seconds per square inch! Precision-engineered, rugged and durable. Motor is 3½ HP, enclosed, fan cooled, induction type 220/440 volt, 60 cycle, 3 phase (other voltages on request).

Machinery by Stone includes a complete line with many optional features. Write for complete information, no cost or obligation.

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Circle No. 224 on postpaid card

sion, an automatic infeed grinding attachment, is available from Modern Devices, Dept. GF, Box 429, Libertyville, Ill. With Feedcision, the human element and all variables have been eliminated. Automatically infeeds and spark out timing—returning to open position and ejecting the finished part.

24. **Lubricants.** A complete packet of literature describing the complete Molykote lubricant line, is available from The Alpha Molykote Corp., Dept. GF, 65 Harvard Ave., Stamford, Conn. "For lubrication's fringe area, where extreme bearing pressures or excessive temperatures defeat conventional lubricants," is the theme of Alpha Molykote's literature.

25. **Disc Sanders and Grinders.** Ten models and five different sizes of single and double disc sanders and grinders are described and illustrated in literature available from Max Mfg. Co., Dept. RG, 138 Stockton Ave., San Jose 26, Cal. Also included in the Max line are abrasive belt grinders, combination abrasive cut-off machines and the Acme line of saw sharpening machines.

26. **Grinding Wheels.** "How to Select Grinding Wheels for Precision Grinding, Tool and Construction Steels" is the title of a booklet available from Norton Co., Dept. FG, Worcester 6, Mass. Booklet consists of reprints of three articles that appeared in "Grits and Grinds," Norton's monthly magazine on better grinding. Articles were written by Clifton C. Nickerson, Norton grinding engineer.

27. **Filters.** Olson Filtration Engineers, Inc., Dept. FF, 1624 N. Kilbourn Ave., Chicago 39, Ill., have literature available describing and illustrating their line of filters. The new Olson filters feature new nonclogging screens, a greater filtering surface, and a completely automatic cleaning mechanism.

28. **Finishing and Polishing.** Type 101 centerless finishing and polishing machines, both high speed and standard speed, are described and illustrated in literature available from Production Machine Co., Dept. G, Greenfield, Mass. Various types of supporting and feeding fixtures can be furnished, the type of which depends on the length and weight of work to be handled. Specifications and design features are given for both types of machines.

29. **Wheel Forming Attachment.** Model No. 10 universal Diaform wheel forming attachment for cylindrical type grinders, for faster and more economical forming and retruing of complex forms on grinding wheels, is described and illustrated in literature available from Pratt & Whitney Co., Inc., Dept. GF, West Hartford 1, Conn. This device is a lightweight, portable instrument that provides a simple method of accurately truing complex forms on grinding wheels in minutes.

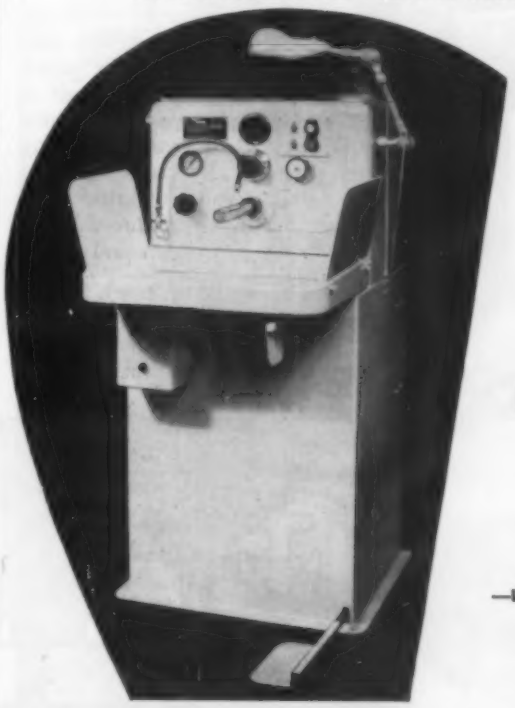
30. **Monochromatic Light.** Spitfire Tool Co., Dept. GR, 2931-35 N. Pulaski Rd., Chicago 41, Ill., has literature available describing and illustrating their new Mono-Lite. Interpretation of light bands through an optical flat using a helium light source (Mono-Lite) assures accurate readings for flatness to .0000116 (1 light band). It is a compact, entirely closed portable unit.

31. **Carbide Tool Grinders.** The carbide tool grinder line manufactured by Hammond Machinery Builders, Inc., Dept. RG, 1600 Douglas Ave., Kalamazoo, Mich., is described in literature available from the company. Complete illustrations, design features, and specifications are given for these machines which can be used for either dry or wet grinding.

32. **Rust Preventives and Coolants.** The complete line of Rust-Lick rust preventives and coolants are described in literature available from Production Specialties, Inc., Dept. F, 755 Boylston St., Boston 16, Mass. Included in line are Rust-Lick C-90, a rust-preventive compound concentrate; Rust-Lick A, a water soluble rust-preventive compound; Rust-Lick B, G-25, and B-50, all grinding coolant concentrates.

33. **Magnetic Separator.** The complete line of Delpark magnetic separators and filters is discussed in literature available from Industrial Filtration Co., Dept. FG, Lebanon, Ind. Gravity action is combined with magnetic force so that the flow of ferrous particles is in their natural direction and the magnetic field does not have to overcome the force of gravity but is instead assisted by it.

Acclaimed at the A.S.T.E. Industrial Exposition as



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2. Hydraulic System also operates clutch and brake mechanism.
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4. Infinitely variable spindle speed; 250 to 1150 r.p.m. The RIGHT speed for work of any diameter, material or finish. Easy to read tachometer.

Spindle has replaceable hardened pilot bushing, mounted on factory sealed bearings. Eliminates constant lubrication. Machine operates by foot pedal while standing, or knee pedal while sitting.

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Holding Device for Surface Grinder

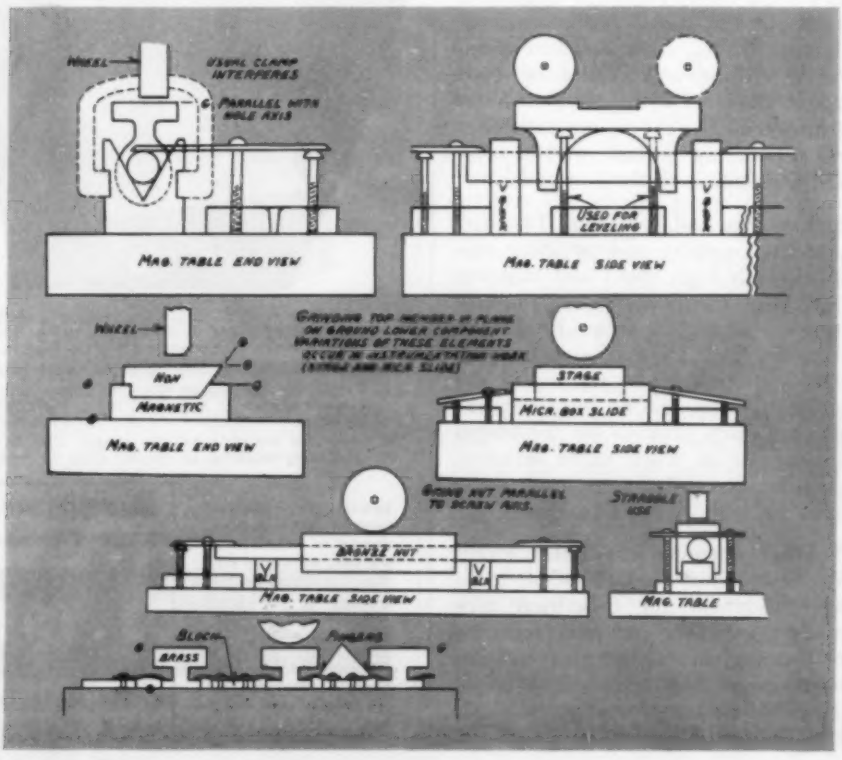
By **Carl J. Raeder**

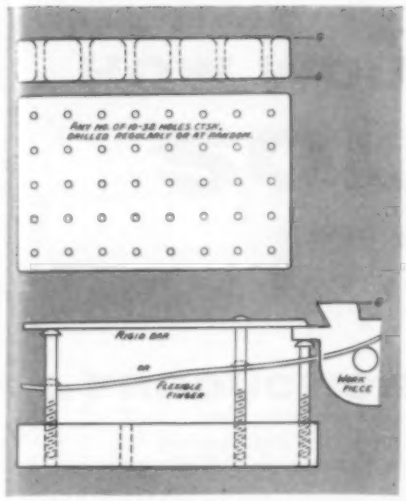
Barring costly fixtures, small lot pieces of odd shape, non-magnetic castings and assemblies that require grinding of a flat or angle are difficult to hold on an angle plate, vise or magnet. Beyond limited use of two-way sticking tape and patented "Magnalox" grippers there is little available to grind parts that were previously machined using hold downs, clamps, t-slots and t-nuts.

This idea has saved me much aimless pawing through a mass of shims, scraps and other junk that has been saved in the hope they may be useful in setups.

It consists of 2 or more CRS ground flats 5-8" thick and 3" by 4" size or as the run of work dictates. Drilled, countersunk and tapped as shown, my version is in daily use.

The blocks, with screws of varying length can be used for elevating and adjusting and simultaneously as hold downs. Flexible fingers are made of ⅛" thick, ¾" wide CRS of suitable length. The bars are thicker with no give. These fingers or bars, with the blocks held magnetically, are versatile and adaptable enough to give a toe





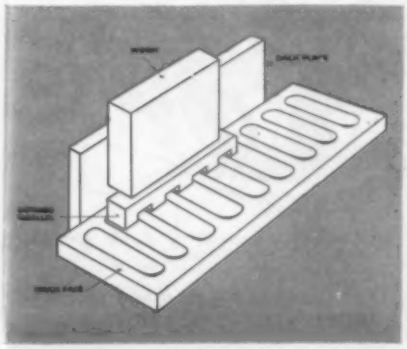
hold on a ridge, shoulder or hole on various shapes while grinding. They do for a magnetic table what straps and t-nuts do on a milling machine or other table. The numerous holes give flexibility in positioning. A few of the possibilities are shown. • •

Accessories for Magnetic Chuck Aid in Setups

By **Clifford Molloy**

We do a lot of grinding in our shop on die blocks and jig and fixture plates. When grinding the edges of these blocks square with the face, it takes a lot of time to clamp them up on an angle plate, so we devised the arrangement shown, which is quicker. We made a large back plate for the magnetic chuck and a set of notched parallels. The notches are spaced so the parallel will only bear on the pole faces of the chuck. This gives proper flow of the magnetic flux in holding the piece.

The work is placed on the parallel and against the back plate. This arrangement provides a good grip on the work and squares it up easily and quickly. The bolt holes through the back plate are slotted vertically so the plate can be set at different heights for different sizes of work. Several sizes of notched parallels can be provided. • •



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Lifting Beam for Ganged Grinding Wheels

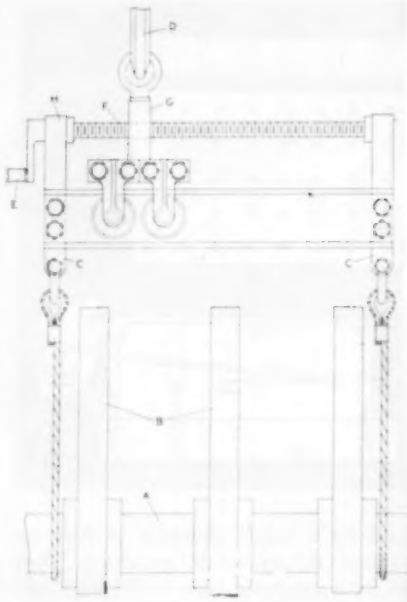
By **C. T. Bower**

Gangs of large diameter grinding wheels are assembled together on one arbor at correctly spaced intervals for the plunge grinding of automobile crankshafts. The wheels are up to 36 in. diameter and the whole assembly is, therefore, of substantial weight necessitating the use of an overhead hoist when changing arbors and when servicing them. The arbor and the wheels are shown in the sketch at A and B, respectively.

Lifting of the arbors is by means of wire rope slings of equal length which pass around the arbor between adjacent wheels and are bolted at their upper ends to lugs C on a lifting beam. The beam spaces the slings the correct distance apart, so that the grinding wheels are not subjected to sideways pressure from the wire ropes.

Even with the lifting beam, it was found that the arbor tended to tip when lifted, owing to the uneven weight distribution along it and the means shown in the sketch was devised for placing the center of gravity of the arbor directly under the hoist lifting hook D.

The lifting hook can be traversed along the lifting beam by turning of the hand crank E. The crank turns the screw F which is in engagement with the threaded hole passing horizontally through the block G to which is attached the hook. To ensure free movement between the lifting hook and the load the block G is fitted at its lower end with a pair of wheels placed at



each side of the beam. These wheels are provided by a pair of standard monorail conveyor fittings, and they engage with the channel section steel of the lifting beam.

The beam is constructed from two identical pieces of channel-section steel, placed back-to-back and secured at the ends by through-bolts. The end pieces H space the channel sections apart and intermediate slinging points can be fitted to the beam between the ends.

When lifting an arbor, the weight is taken by the hoist and any tilt can be corrected easily by the operator traversing the crane hook fitting along the beam until perfect balance is achieved. A further valuable feature of the beam is the ability to remove wheels from the arbor while it is still suspended from the hook. The shift of the center of gravity brought about by removal of a wheel from the arbor can be allowed for by adjusting the hook along the beam. • •

VERSATILE PRECISION GRINDING!

Or a combination of both . . . or specials for single purpose application

Constant speed motor delivers consistent spindle speed under any load within rated capacity. External and internal grinding heads are interchangeable . . . internal spindles reversible for either left or right precision grinding . . . direction of rotation changed to suit. Large, flat mounting pad (with ample bolt slots) adds to grinder's versatility . . . can be mounted to nearly any other production machine for a wide range of accurate work, large or small. For adaptation to special, single purpose applications, write for details. Successfully used for grinding both the common and unusual materials.

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Division of The R. K. LeBlond Machine Tool Co.

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"I've launched her as a new incentive system."

HOW WOULD YOU SOLVE IT?

1. PRODUCTION PROBLEM: To cut unit costs and increase production of grinding off parting lines and other imperfections, and polishing die-cast aluminum vacuum cleaner nozzles prior to plating. Scott and Fetzer Co., makers of famous Kirby vacuum cleaners, were using set-up wheels in a three-grit sequence – #60, #120, #220 – to do this operation. Production was 6 finished units per hour.

2. SOLUTION: A 3M Representative suggested that this Cleveland, Ohio manufacturer switch to the 3M Method using Three-M-ite Cloth Belts, Grits #120 and #220. This method increased production 116% – from 6 to 13 finished nozzles per hour – *and* eliminated one grinding operation! Too, the finer polished surface obtained with 3M Belts made for far superior final plating.

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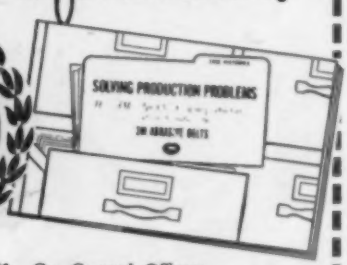

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New Automated Barrel Finishing Systems Produce Better Finishes at Greater Cost Savings

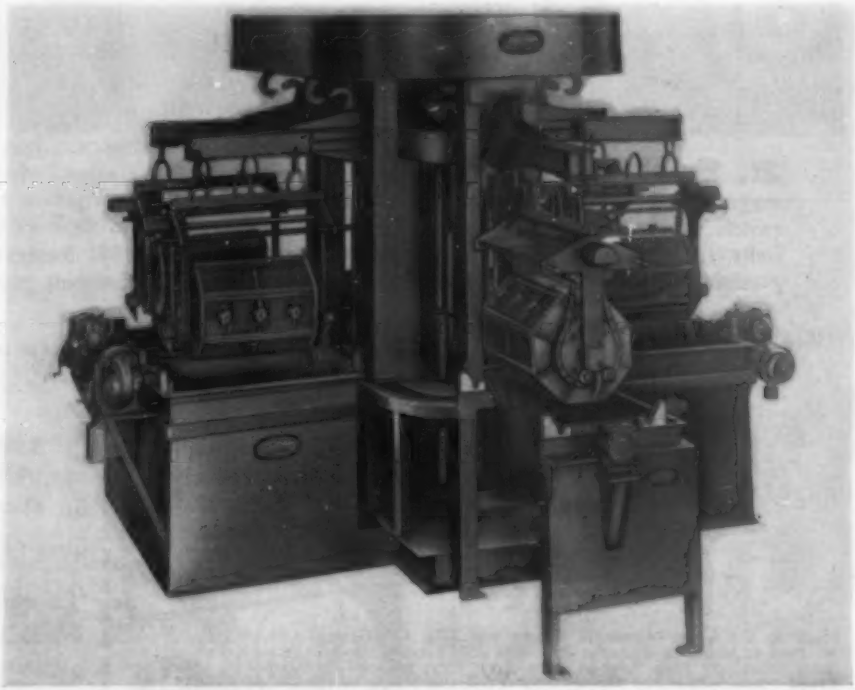
Two types of automated barrel finishing systems, have been announced by ALMCO, Division of Queen Stove Works, Inc., Albert Lea, Minnesota.

These systems are now in use for micro-precision finishing of stamped, die cast, machined, extruded and centerless ground parts. The complete finishing process is automatic from beginning to end, controlled by one operator and pre-set switches. Finishing operations performed in this system can include: descaling, degreasing, grinding, deburring, burnishing, rinsing and rust inhibiting of metal parts.

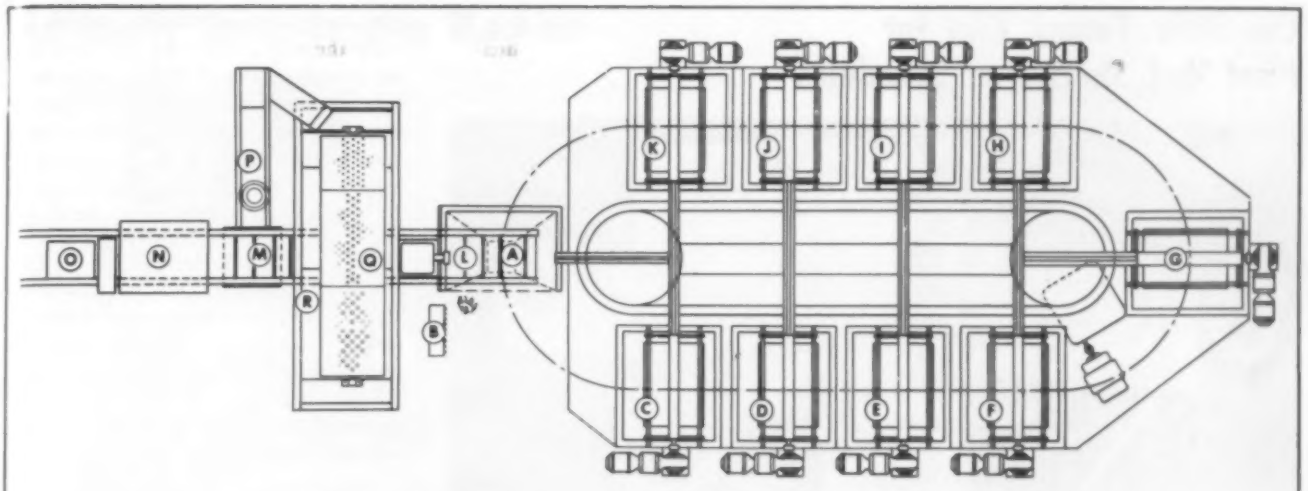
Besides uniform finishes and greater production possible by Supersheen automated systems, unusual cost savings on finishing compound materials and labor costs in comparison to standard barrel finishing methods have been experienced.

The systems are the ALMCO Sub-O-Matic Skip-Station type and the ALMCO Sub-O-Matic In-Line type of automated barrel finishing. The Skip-Station system can simultaneously finish a variety of parts requiring different finishes by automatic programming feature. The In-Line system is particularly suitable for finishing high production parts of different types requiring the same finishes and processes.

Of special importance in the Supersheen automated systems are the materials handling systems; even delicate centerless ground steel parts can be handled throughout the system without



The ALMCO Sub-O-Matic Skip-Station Automated System performs all finishing operations by submerged-type barrel finishing.



FLOW DIAGRAM OF SUPERSHEEN SUB-O-MATIC SKIP-STATION SYSTEM

10-station Sub-O-Matic system Barrels index every 3½ minutes. **TIME CYCLE:** 40 minutes per barrel. Barrels "dwell" above tank 45 seconds between stations. A barrel of parts is being unloaded every 3½ minutes.

A. Load-Unload station.

B. Control Panel.

C. Clean and Degrease Tank or Station.

D, E, F, G, H, I. — Grinding and Burnishing Tanks.

J. Clear Water Rinse Tank.

K. Rust-Inhibitor Tank.

L. Parts and media are metered to Belt Conveyor at Unload-Load Station.

M. Magnetic Separator separates parts from media.

N. Parts pass along Conveyor through Drier unit.

O. Parts are conveyed to "pick-off" table where one or more operators remove them for assembly or storage.

P. Abrasive media drops into Vertical Bucket Elevator.

Q. Bucket Elevator raises media to overhead Rotary Screen Classifier.

R. Media is separated according to size and drops into Retaining Bins or Hoppers. To recharge barrels, an air-operated control meters the correct amount and sizes of media; parts are then placed in the media mass and barrels are again ready to enter finishing system.

part-on-part impingement. In unloading, the parts and abrasive media are emptied from the barrel to a belt conveyor; parts are then separated from the media by a magnetic separator and then pass through drier unit to a "pick-off" table for assembly or storage.

The media drops into a vertical bucket elevator and is raised to an overhead rotary screen classifier. At this point the different size media pass through the classifier and fall into retaining bins of an overhead media storage hopper. Up to 10,000 lbs. of media per hour can be handled by this arrangement.

In the Skip-Station Sub-O-Matic automated system, the barrels move from one finishing tank to the next with all barrels indexing at the same time. A special feature of this system is the automatic programming which permits barrels to by-pass tanks by a preselector switch on the control panel. This allows the barrel to "dwell" above the tank until the time cycle is completed; then, the barrel indexes to the next station and enters the finishing tank for processing. In this way, different finishes and processes on various parts can be obtained during the same processing cycle. For example, a load of parts may not require descaling, or burnishing; in this instance, both of the tanks would be by-passed, the barrel would only enter the de-burring, grinding and rinsing stations.

The systems employ a power-and-free conveyor system to take barrels into the finishing system. Barrels index simultaneously from one tank to the next by automatic walking beam. After completing the process, barrels enter the unloading station where barrels are positioned and emptied by a jog switch. Ferrous parts are separated from abrasive media by magnetic separator; in applications where parts are non-ferrous metal, a vibrating screen is used for the separating operation. The barrel is then reloaded and is ejected into the power-and-free conveyor system which takes it back to the finishing line.

These automated barrel finishing systems can be engineered to meet the requirements of mass production parts that run to hundreds of thousands weekly. Finishing departments now using two or more conventional type finishing barrels in continuous production can also profit by the many advantages of these automated systems.

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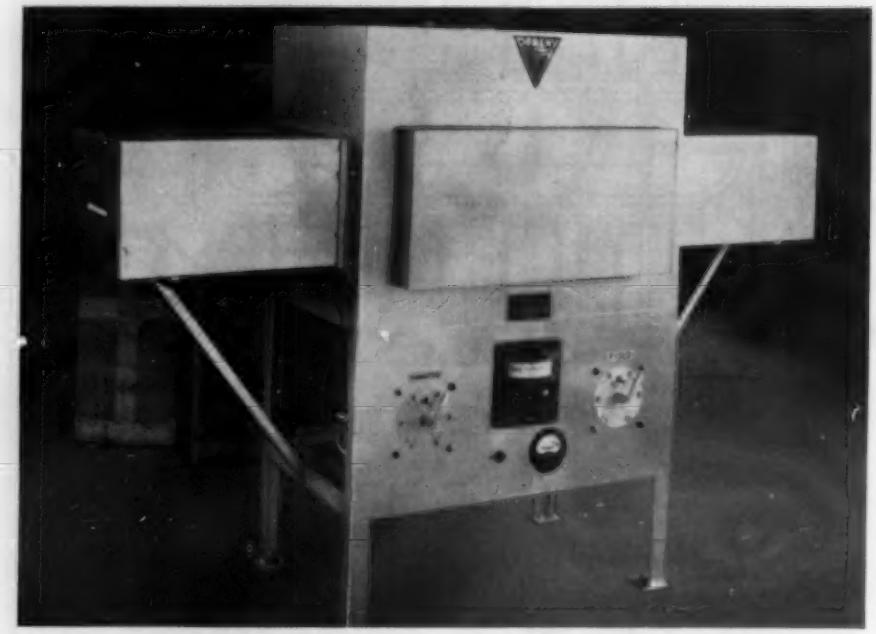
These improved NIELSEN live centers for **grinders** are fitted with deflectors to protect bearings from grinding compounds. Have adjustment to take up wear and preload bearings.
This special **grinding** center available with any size point desired. Any size or type taper shank. Complete details and folder furnished on request.

Live Centers

Nielsen, Inc. Lawton, Mich.

Circle No. 229 on postpaid card

One-Hour Tunnel Kiln for Pilot and Short Run Schedules



A new short-period tunnel kiln, designed especially for pilot and short run production schedules utilizes silicon carbide elements located over and under the hearth, and has an operating temperature of 2100° F. Power requirement is 10 KW.

The unit comes as a complete package, ready for installation, which involves merely connecting the unit into the power source. A sliding plate type (but manually fed by pushing "green" items through without the use of support plates) the unit has an over-all length of 78″ (three equal zones of 26″). Cross sectional area of the chamber is 10″ x 3″.

Controls include voltage-regulating transformer, switches, input ammeter and magnetic contactor and automatic indicator-controller with thermocouple. All power and temperature controls are mounted and wired in a panel at the base of the kiln.

Andrew Pereny, president of the company, says the unit is ideal for single-fired items in which the green firing and glazing are combined into one operation. The total firing schedule from loading to unloading end is one hour.

Complete information on the new Pereco kiln may be had by addressing Andrew Pereny, president, Pereny Equipment Co., 893 Chambers Rd., Columbus 12, O. •

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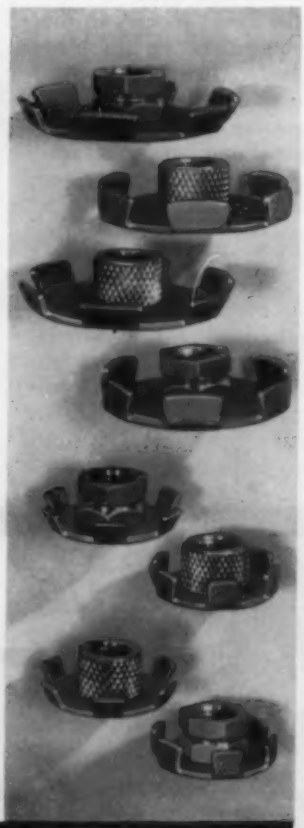
FOR SAFETY'S SAKE USE

CARROLL-LOCK GRINDING WHEEL INSERTS

These specially designed, sturdy units give increased torsional strength to your wheel assemblies . . . up to 500% with the lock itself, and up to 1500% with the brazed type! The Carroll Line of metal components and assemblies has been designed and developed to give Grinding Wheel Manufacturers a stronger, more concentric metal part, resulting in a safer, more uniform grinding wheel.

Our many years of experience in the metal working field has enabled us to assist Grinding Wheel Manufacturers in the solution of many problems involving their metal components.

Send for the illustrated catalog today.



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138 DEWEY ST., WORCESTER, MASS.

OVER 50 YEARS OF PRECISION METAL FABRICATION

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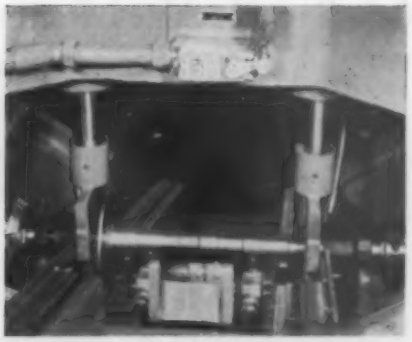
"Could I use the Caddy tonight, Boss? Your daughter and I have a date!"

Automatic Center-Lapping Machine

A new concept in center-lapping high production parts was revealed recently in a completely automatic machine engineered and developed by Industrial Metal Products Corp. of Lansing, Mich.

In operation, parts are fed from a conveyor onto an inclined magazine loader, then set automatically in the workholding fixture, hydraulically clamped, center-lapped on both ends and ejected onto the unload track at the rate of 300 pieces per hour.



The new machine employs two IMPCO center-lapping units. Each is equipped with an automatic dresser which dresses the stone after each cycle, or as required, and resets itself to adjust for amount of stone removed. The units are also equipped with automatic control panel lights that flash on when stones have been used to minimum length, and to indicate that the machine has shut off and reset itself for new stones.

Close-up view shows the loading and unloading tracks with the part clamped in the workholding fixture and stones advanced to the part. Parts are lapped with coolant. Micrometer adjustment dials are provided to adjust stones on initial set-up. •

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TO BALANCE GRINDING, BUFFING AND POLISHING WHEELS...

No setup, no leveling, no centering. Chilled iron discs, ground and balanced to extreme accuracy, rotate with minimum friction on special bearings. Glass-hard spindles and bearings minimize wear or ball-bearing indentations when balancing heavy weights. Accuracy lasts throughout the long life of balancing ways. Proved and preferred 38 years. For information on sizes, types, and prices of Anderson Ways,

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Anderson

ANDERSON BROS. MFG. CO.

Rockford, Illinois

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Grinding Machines Feature New Improvements

Notable improvements in accuracy, versatility and ease of operation for their 12″, 14″ and 18″ Universal Grinding Machines have recently been announced by Cincinnati Grinders Inc.

Filmatic bearings have been retained for the grinding wheel spindle. Multiple segments support the spindle accurately and rigidly on high pressure, wedgeshaped films of oil. The bearings are self-adjusting for heavy roughing cuts or light finishing cuts and require no maintenance for the service life of the machine. Lubrication of the spindle bearings is automatic and positive, and an automatic cut-out is provided to stop the spindle drive motor if lubricating pressure should fail. 12″ machines have 3 hp spindle drive motor; 14″ and 18″ machines have 5 hp motor.

The table feed is hydraulically powered and feed rates are infinitely variable, by means of a single control knob, from 3″ to 240″ per minute for 12″ machines; from 3″ to 220″ per minute for 14″ and 18″ machines. Table reversal may be automatically dog controlled from full rated stroke to as little as 3/32″, short enough to produce an effect similar to that of a grinding wheel reciprocating attachment. Accuracy of table reversal at any table speed is within .004″. Table tarry at reversal is independently adjustable for each end of the stroke from 0 to 5 seconds. Hand traverse of the table is mechanically driven and has two rates —a fast movement of 1″ per revolution of the handwheel for set-up purposes and a slow movement of 0.2″ per revolution for fine adjustments and for shoulder grinding. The table ways are pressure lubricated with filtered oil and are protected from dust and grit by telescoping guards at each end of the table.

Hand cross adjustment of the wheelhead is accomplished with a two-speed handwheel control which provides .250″ cross movement per revolution of the handwheel in fast feed; 050″ per revolution in slow feed. Minimum cross feed adjustment is 25 millionths, or 50 millionths on the work diameter. The handwheel is provided with a clutch release lever to simplify setting up. When the grinding wheel is brought in contact with the work you simply flip the release lever which disconnects the handwheel, allowing it to be rotated against the positive stop and then instantly re-engaged.

Automatic pickfeed at table reversal is hydraulically actuated and infinitely variable from .0002″ to .005″ on the diameter in the low crossfeed range, .0005″ to .0125″ in the high range. The pickfeed mechanism automatically picks all the way to size against the positive stop. A convenient control knob permits selection of pickfeed at either or both ends of the workpiece.

Additional details and specifications may be obtained by writing to Cincinnati Grinders Inc., Marburg Ave., Cincinnati 9, O. Ask for Publication No. G 663, or circle number on Reader's Service Card. •

Use HANDY Postpaid Card. Circle No. 104

Cut-Off Machine Uses Abrasive Wheel or High-Speed Saw Blades

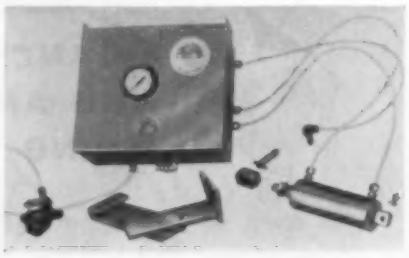
An entirely new model cut-off machine has been announced by Walker-Turner, Inc., of Plainfield, N.J.

This newest machine in the popular Light-Heavyweight line is available for use with a dry-cutting abrasive wheel for cutting rod, bar and tubing stock, and the same machine may also be used with high-speed saw blades, and with conventional wood-cutting blades.

The manufacturer points out that the precision of the machine is such that it cuts true and clean, and in this way, eliminates many finishing operations.

This new cut-off machine is available equipped with an Air-Feed attachment for repeated production operations. This is a 100% pneumatic device, which requires no electrical connections and can be installed without machining. This Air Feed attachment can be used in connection with either automatic stock feed, or hand feed.

An automatic spray coolant system which supplies coolant to the blade while cutting is also available. This system may be used on either hand or air operated machines. Economy of operation is a feature, because coolant is applied only during the actual cutting.



A similar coolant system, using a recirculating pump is also available.

The heavy cast iron table comes drilled so that the head may be mounted at 45° for mitering, and the table may also be drilled and tapped for any desired work holding devices.

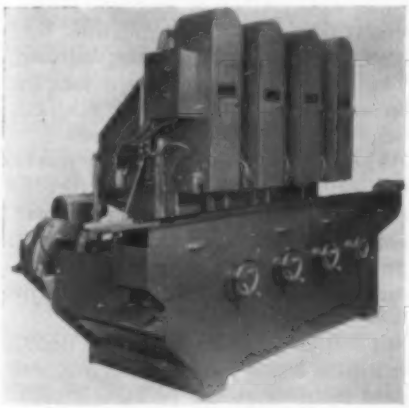
This new machine takes abrasive wheels and saw blades up to 12″ diameter. Blades or wheels are guarded by a heavy cast iron guard which manufacturer claims provides 216° peripheral protection to the operator. A 3-horsepower, 220/440 volt 3-phase motor is supplied with the machine. It is totally enclosed, fan-cooled, ball bearing, and has an overload capacity up to 7 hp. •

Use HANDY Postpaid Card. Circle No. 130

Four-Head Conveyor-Type Abrasive Belt Grinder

This new contact-wheel abrasive belt machine, permitting four simultaneous grinding operations, is manufactured by the Engelberg Huller Co., 831 W. Fayette St., Syracuse 4, N.Y. Designed for high-volume flat surfacing of ferrous and non-ferrous metals, glass, plastics, ceramics and other materials, the four-head Model 680-4 belt grinder produces extremely fine micro-inch finishes to exacting tolerances, and makes possible a single-cycle operation from rough casting to polished part.

Typical multiple grinding sequence, using a series of progressively finer belts is: rough grind, two semi-finishes, and finish grind. One pass under the four heads can remove an approximate maximum of .020-inches of steel stock, and up to .060-inches for other materials and applications.



The Model 680-4 is applicable to both wet- and dry-belt grinding. Approximate capacity of cooling unit, equipped with ½ hp coolant pump, is 100 gallons.

The machine is particularly adaptable to automatic production lines. Parts can be conveyorized for presentation to the conveyor belt, automatically ejected, and carried to next operation. Size of machine conveyor belt is 6½" by 216'. Quick manual adjustment of conveyor belt speed is obtainable for settings of from 2 to 25' per minute.

Abrasive belt size is 6" x 80", and abrasive belt speed of individual heads is constant at 5500 sfpm. Belt tension is adjustable by a simple twist of control wheels; and for extra operator safety, the machine will not run unless belts are tensioned.

The 680-4 has a maximum piece capacity of 5" high, 6" wide, any length. This machine is 125" long, 51" wide, and 90" high, and weighs 5500 pounds. Heads are powered with either 5 or 7½ hp drives, and the machine can be modified for five- and six-head applications. Magnetic chucks are optional. •

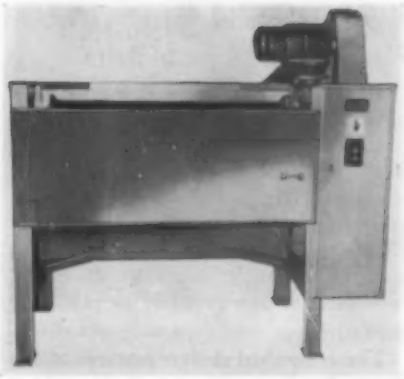
Use HANDY Postpaid Card. Circle No. 105

Barrel Finisher Offers Various Barrel Combinations

Made in any interchangeable combination of barrels from 2, 4, 6, or 8 cu. ft. capacity, with total capacity of 8 cu. ft., this new Rampe V-8 barrel finisher provides a versatility that will meet all requirements.

Another feature is the improved power drive, which has direct gears, no chains or sprockets, and provides low maintenance cost. A safety gate is located in front of the machine which completes the all around protection of the unit.

A 1½ hp magnetic brake motor with jogging and reverse switch provides adequate power. Other specifications are: Variable speed drive; waterproof start-stop switch mounted in the front panel; and anti-friction bearings.



Barrels can be furnished with their well proven No-Seam vinyl plastic lining which gives extra wear and chemical resistance. Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10, O.

Use HANDY Postpaid Card. Circle No. 106

Bearings, Inc. takes sick, worn out or damaged High Speed Grinder and Precision Boring SPINDLES and makes them NEW again . . . in HOURS . . . not weeks

Above is our Spindle Repair "doctor" checking the "heartbeat" of a rebuilt spindle with a stethoscope. He's listening for sounds of rubbing seals or any uneven tone at various speeds that might spell bearing trouble in the making. This is an example of the care we regularly use to make certain the spindles we rebuild are returned to normal accuracy at all speeds.

Our air conditioned repair center, trained mechanics and the immediate availability of the bearings required by all types of spindles or quills, allows us to promise faster service and guaranteed satisfaction on all work we undertake.

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Gentlemen:
Please send me complete information on your spindle repair and rebuilding service.

Name .....
Firm .....
Address .....
City ..... Zone..... State.....

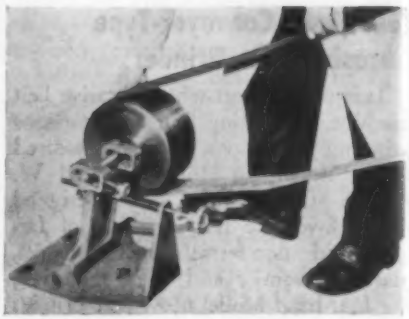
Circle No. 233 on postpaid card

New Backstand Idler For 4, 6 or 8 inch Belts

The Curtis Machine Corp., Jamestown, N. Y., has announced the addition of the BS Series, a completely new Backstand Idler, to their extensive line of industrial abrasive belt grinding, polishing and deburring equipment. This unit, available for 4", 6" or 8" wide belts, can be easily set up as the belt idler for any grinding or polishing lathe.

The simplified design features a foot pedal for belt tension release, which leaves both hands free for changing the belt. Positive belt control is assured with adjustable spring loaded belt tension and accurate tracking control. Sealed ball bearings in the 10" diameter pulley will give long trouble-free service with speeds of up to 10,000 s.f.p.m.

Easy to install, it can be mounted on either the floor, pedestal or wall without the use of adapters for operations on either the right or left side of a polishing lathe. The unit has sufficient adjustment to compensate for belt length, when different diameter contact wheels are used, so that belt speeds of 5600 to 7500 sfpm are possible with a single speed of 1800 rpm lathe. Remote tracking control and pneumatic tensioning are available on the BS Series Backstand Idler at additional cost.



Use HANDY Postpaid Card. Circle No. 107

Magnetic Separator and Filter Features New Design Improvements

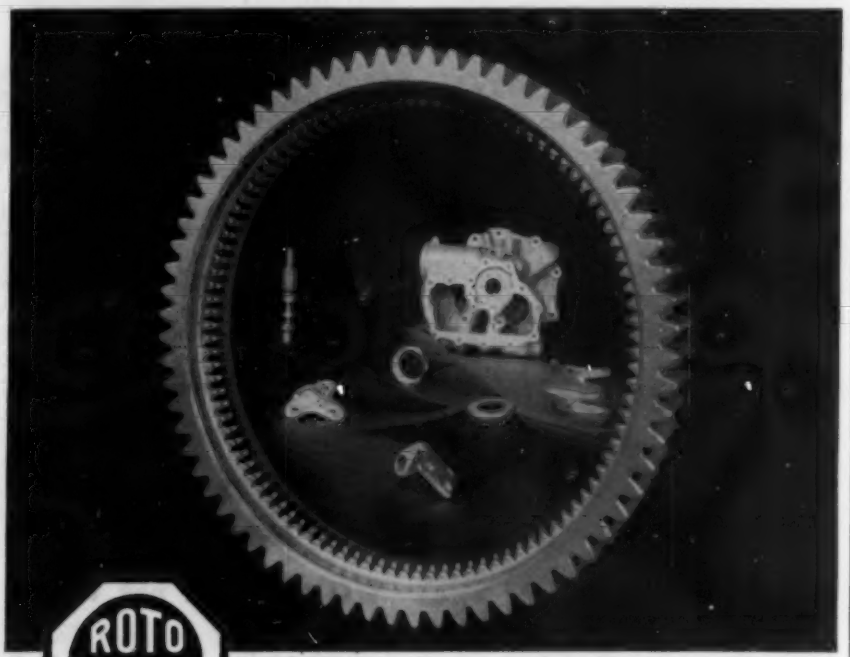
The Delpark Up-Flo filter with permanent, bar stock bronze screen has been redesigned to include the added features of magnetic separators. Delpark's new method of magnetic separation makes use of a flat magnetic field on to which the liquids are diffused. This new principle of design uses the force of gravity to assist the magnetic field.

The efficiency of the extremely powerful magnetic field is even further increased. This large, most powerful magnetic area of No. 5 Alnico magnets gives twice the width of field and permits lower flow velocity which prevents washing and turbidity.

The Up Flo action carries the liquids that have been exposed to the magnetic field up through the permanent .004" bar stock screen to remove particles such as abrasives which do not respond to the magnets. The liquid flows into a storage tank where settled particles smaller than .004" are removed by chain driven flights.

The bar stock screen is cleaned by air shakers which shake embedded particles from the screen. This residue with the ferrous particles is removed by separate chain driven flights. Up-Flo Filters are available without magnets for non-ferrous metal applications. Industrial Filtration Company, Dept. VM-478 Lebanon, Ind.

Use HANDY Postpaid Card. Circle No. 108



ROTO FINISH

it's the finish that counts!

Roto-Finish maintains exact tolerances on precision parts with no significant dimensional changes. It makes possible a wide range of finishes applicable to parts of almost any size or shape; finishes a variety of materials — at big savings in manpower and costs. Without obligation, send sample unfinished parts to us. Include finished part for guide and your specifications. Roto-Finish will finish parts in its laboratory. You get a complete process report. You are guaranteed results and a finish that counts!

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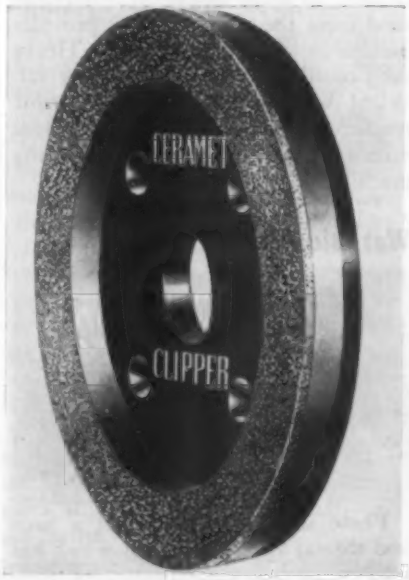
Circle No. 234 on postpaid card

New Bond Improves Cutting Action of Diamond Wheels



A new bond for diamond wheels has been introduced by Clipper Diamond Tool Co., Inc., 21G W. 46th St., New York 36, N.Y. According to the manufacturer, the Cera-Met wheel does not glaze even if carbide and steel are ground at the same time. These wheels are claimed to cut up to 300% faster than metal bonded wheels, maintain sharp corners longer, and do not require frequent dressing.

The Cera-Met bond actually wets and adheres to each diamond grain regardless of how fine, gripping it so firmly that you cannot knock it out, you have to wear it down. After the diamond is worn flat, a breakaway action will release the diamond particle, thus exposing a fresh diamond edge. This action continues throughout the life of the wheel so that the grinding surface is always clean and sharp. •

Use HANDY Postpaid Card. Circle No. 100

Finishing Paper in New Grits and Weights

No-Load finishing, which was recently introduced by the Coated Abrasives Div., Armour and Co., Alliance, O., is now available in many new grits and weights.

Crystolon No-Load finishing paper, which is used in the metal working industries, is now available in grits 80, 100, 120, 150, 180, 220, 240, 280, 320, 360, 400, and 500 in "A" weight and 150 in "C" weight.

Garnet No-Load finishing paper for the wood working industry is now available in grits 80, 100, 120, 150, 180, 240, 280 in "A" weight and 80 and 100 in "C" weight.

No-Load Finishing Paper is said to last longer, cut faster and provide a better finish than waterproof paper and at a minimum saving of twenty-six percent. It has a non-filling surface coating which won't come off when moistened or during sanding operations. Added sharpness is built in by means of an improved method of electro-static grain coating. It has a new binder adhesive specially formulated for the No-Peel grain layer. This prevents grain shedding when sanding sharp or rough edges. The new tough flexible backing contains a special rubber base incorporated by a unique treating process which prevents slipping in the operator's hands. •

Use HANDY Postpaid Card. Circle No. 110

Wheel Dressers Feature Ball Bearings to Eliminate Drag

A complete line of wheel dressers is being manufactured by Abrasive Truing Tool Corp., 1100 E. Washington St., Freeland, Mich., that incorporate

ball bearings to overcome and eliminate drag during dressing operations.

Wheels can be dressed either for finishing or for roughing with these tools, and more pieces per dressing are said to be the result.

This company has been making a complete line of wheel dressers since 1917, and manufacture special dressers to fit any machine. •

Use HANDY Postpaid Card. Circle No. 111

Production CENTERLESS

GRINDING & FINISHING MACHINE

PEERLESS WIDE BELT SURFACER . . .
for wood, plastic and metal

In addition to centerless machines, Production Machine Company also makes the famous Peerless Abrasive Belt Surfacers.

Of heavy duty construction throughout, these machines are built to operate continuously on all types of platen grinding, sanding, and surfacing jobs using abrasive belts. Available in vertical type as illustrated with work table and miter gauge adjustable for angles to 45°. Horizontal type has moveable work stop and may be adjusted to any position on the platen.

Made in three sizes for belts 9", 14", or 20" wide. Write for bulletin with full specifications. Dept. F.

PRODUCTION MACHINE CO., Greenfield, Mass., U.S.A.

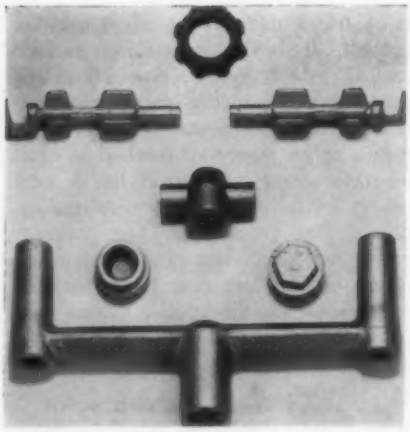
Circle No. 235 on postpaid card

Lustrous, Etched Finishes Less Expensive with Steel Grit

A trend toward using steel grit blast cleaning abrasive for etching nonferrous work and producing lustrous finishes has begun, according to Wheelabrator Corp. of Mishawaka, Ind.

Cleaning department supervisors report that, savings are being achieved from steel grit through a reduction in abrasive consumption. This stems from the fact that cast steel abrasives, although having high hardness, can possess the ability to resist rapid breakdown. They wear down rather than chip away upon impact, so they have longer useful lives. The fact that they don't chip away makes additional savings in terms of blast cleaning machine wear. Particles that do not chip remain free from sharp edges which cause machine wear.

A typical experience with steel grit abrasives is that of W. E. Foreman Co., Peru, Indiana. The Foreman Co. is a small jobbing foundry, producing brass and aluminum sand castings. It pours about 1½ to 2 tons of brass per day and therefore uses an automatic airless abrasive blast cleaner. Steeletts grit is used. Wheelabrator engineers recommended size GL-50 after consideration of the size and character of the castings.



Some typical brass sand castings blast cleaned with steel grit abrasive (Steeletts) at W. E. Foreman Co. At top is a part before blast cleaning.

Blast cleaning time is an average of 7 minutes per load, for the brass. Blasting is done after grinding. The gates are then blasted separately for 2 minutes' time, so that they are free of contamination for remelting in the electric furnace.

The Foreman Co. experienced other benefits from steel grit, in addition to less rapid breakdown, as compared with other abrasives of similar hardness. These included attainment of a more natural color on the metal, either with brass or aluminum. And since reduced breakdown produces fewer small particles of abrasive, ventilation of the blast cleaning machine was increased, for more efficient separation of sand from the abrasive. This provides maximum cleaning efficiency. Heavy sand conditions, if not relieved by sufficient ventilation, lengthen the time required for cleaning. They also cause excessive wear on the blast cleaning machine. •

Use HANDY Postpaid Card. Circle No. 112

Wet Blast Unit

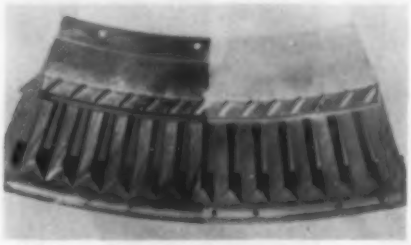


Photo shows a segment of a vane and shroud assembly half of which has been cleaned on a new automatic pressure blast wet blast unit manufactured by The Cro-Plate Co., Inc., 747 Windsor St., Hartford, Conn.

Scale and excess braze is successfully removed from all areas of the part without danger of stock removal, distortion or heavy etching. Manually operated pressure blast units are also available. •

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SUPER 30
GRINDER MILLERS

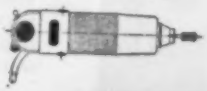
World's most powerful and accurate hand!

Precise Super 30 Grinder-Millers bring new speed, accuracy and versatility to production or toolroom milling, grinding or finishing operations. They weigh only 35 ounces, yet deliver 45,000 RPM, have a strong ⅛ H.P. motor, are accurate to .0001", run cool and can be used by hand or mounted on machines with abrasive wheels or new tungsten carbide tools. Save time, improve quality, increase tool life, and discover new tooling possibilities with the PRECISE SUPER 30.

Attach this ad to your letterhead for FREE demonstration or literature!

High RPM Milling Machines

Precise Power Quills



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Quality and precision since 1882

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WALLS TU-WAY BELT SANDER

Full 1/3 h.p. G. E. Motor

USE IT EITHER WAY

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

Illustrated Literature on Request
A few desirable distributor territories still available.

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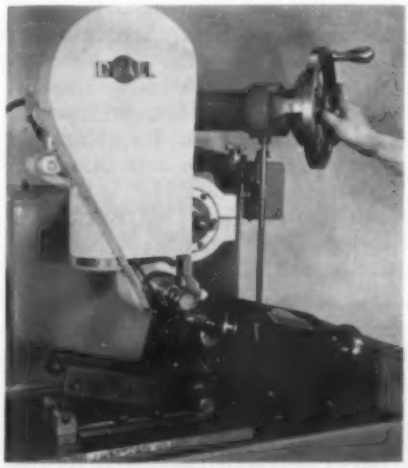
Production Applications of Surface Grinding Explained In New Film

"Extending the Range of Modern Surface Grinding" is the title of a new 16mm sound color film, which constitutes a liberal education in the relatively unfamiliar but highly profitable phases of surface grinder applications that are unfamiliar to a good deal of industry.

Released by The DoALL Co. of Des Plaines, Ill., it examines new grinder features and attachments that permit application of the surface grinder to hundreds of jobs other than ordinary flat grinding. Informative sequences show the use of attachments such as the high-speed spindle for grinding hard-to-reach surfaces and recesses with small wheels and cylindrical grinding and indexing attachment for grinding tapers, squares, angular and multi-surface forms.



Scene from the film showing a part being notched on a standard grinder using high-speed spindle and cylindrical grinding attachments.

Various methods of dressing the grinding wheel to achieve flat or shaped surfaces is covered in another scene. Here, is shown the installation and operation of various types of wheel dressers such as radius-angle, template and crush dressers.

Machine features that permit flat or form grinding on an automatic basis introduce a section on production operations in this film. Adaptation of standard grinders to automatic operation through the use of standard attachments is an interesting development revealed in the film. Viewers will see the standard automatics "downfeed," crossfeed and stop at a desired dimension in a robot-like manner. Actual automatic production grinding of such parts as vanes for power steering pumps is depicted.

Special automatic grinders designed for high-speed operations on a specific part is the last theme. These scenes give close-ups of hopper-fed, high-speed automatics grinding rotors for power steering pumps at fantastic rates, an example of the possibilities for shaping and finishing complex parts with one machine, one setup and one operation through the use of the surface grinder.

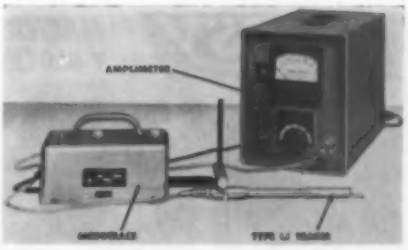
• •

Use HANDY Postpaid Card, Circle No. 114

Portable Equipment Combination for Measuring Surface Roughness

Micrometrical Manufacturing Co., 345 S. Main St., Ann Arbor, Mich., has announced the Profilometer Group II —a versatile, portable equipment combination for measuring surface roughness in the shop. This equipment is said to measure more than 85% of all the varied surfaces produced by industry.

The equipment includes an Amplimeter, a type LJ tracer, and a Mototrace for mechanical operation of the tracer. The tracer measures on ID's as small as ¼", OD's as small as ⅛", flats, tapers, and narrow splines, and passes through a ¾" hole. The Mototrace provides a smooth reciprocating tracing motion of 0.3" per second over any desired length of trace from 1/16" to 2-¾". The Amplimeter shows either arithmetical or rms average roughness height, and has six ranges, with full-scale readings of 3 to 1000 microinches.



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Aircore method saves $1242 on set-up wheel operations

Calculate the cost of operating one of your set-up wheel stations. Take 1/3 of that figure and you have the cost of doing the same jobs with Aircore Wheels. Your yearly savings per station can vary anywhere from $301 to $2184 depending on your present regraining costs.

Aircore Wheels are designed to perform the same jobs commonly done with set-up wheels. One large automobile manufacturer used set-up wheels to blend lead filling into rear fender contours. They switched to Model 535 Aircore Wheels using 36 to 48 grit abrasive bands. Not only did they realize considerable savings, but production was increased and a better finish was obtained.

Facts and figures are important, but they are of what others have done. How will Aircore Wheels work on YOUR jobs? How much will YOU save by replacing your set-up wheels with Aircore Wheels? You will know the exact answers when you put an Aircore to test.

DO SO AT OUR EXPENSE. Send for 25-day free trial. Give job requirements and type and size of power tools used. The name of your nearest Nu-Matic Distributor is available upon request.

N-115

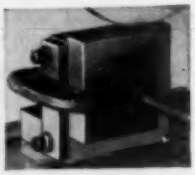
Nu-Matic Grinders, Inc. • 8224 Carnegie Ave. • Cleveland 3, Ohio

Circle No. 238 on postpaid card

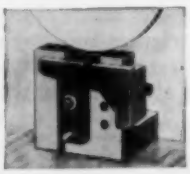
LASSY MASTER V-BLOCK

ANGLE PLATES

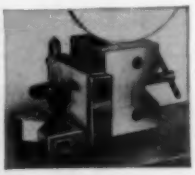
This Master V-Block Angle Plate is an improved new design. Saves hours of setup time. Assures precise work accuracy. Requires less skill.



Side Gage automatically squares work precisely and without removing angle plate from chuck. Repetitive accuracy maintained.



Adjustable parallel holds the smallest work for position and clamping with ease and accuracy.



LASSY MASTER Angle Plate provides a master setup for regrinding of worn or inaccurate Angle Plates.

WRITE FOR DESCRIPTIVE LITERATURE

LASSY TOOL COMPANY

PLAINVILLE, CONNECTICUT, U.S.A.

Circle No. 253 on postpaid card

Contact Wheel Belt Grinder

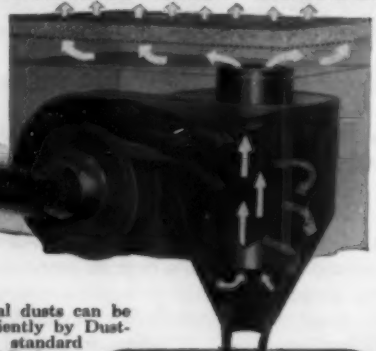
The Model 500 contact wheel belt grinder, is said to increase production 25% or more over old grinding and finishing methods. Its construction allows 360 degree rotation of the contact wheel itself, permitting easy height adjustment for the convenience and comfort of the operator, or it may be revolved 180 degrees, permitting the removal of the aluminum idler wheel and installation of a contact wheel in its place of either larger or smaller radius and permitting grinding in areas that are difficult to reach with 1 size contact wheel. The installation of dual contact wheel on idler spindle does not change belt grinding speed per minute and affords maximum production at all times. This rotation adjustment is made by loosening only one knob. Rotation permits proper location of the platen for more efficient, productive operation.

This versatile machine can be mounted almost anywhere and requires only 4 bolts. Uniform speed of belt provides smooth, even finish. High speed removes stock more rapidly. Flexing belt works out cuttings and keeps abrasive clean. Roughing and polishing can often be done in one setup. A minimum of 1 H.P. is required for driving the Model 500. B & E Mfg. Co., Inc., 2104 E. 31st St., Kansas City, Mo. •

Use HANDY Postpaid Card. Circle No. 116

CYCLONE SEPARATION

FOR MORE EFFICIENT DUST COLLECTION —FILTERS LAST LONGER



Almost all industrial dusts can be collected more efficiently by Dustkop. Thirty-seven standard models *ready to use!* Reduce installation costs — save space. Write for descriptive literature.

DUSTKOP STOPS DUST

ALSO A COMPLETE LINE OF MIST COLLECTORS

AGET MANUFACTURING COMPANY
1380 EAST CHURCH ST., ADRIAN, MICH.

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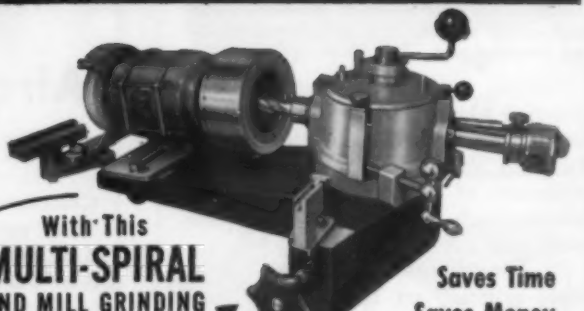
SHARPEN END MILLS
Quickly, Completely, In Your Own Shop



With This MULTI-SPIRAL END MILL GRINDING FIXTURE

Saves Time
Saves Money

- Simple to operate
- Finish-grind spiral lips and end in one operation.
- Grind left hand end mills as easily as right hand.
- Do "Radial Relief" by grinding inside the wheel.
- One million different leads, right and left hand.

Enables you to sharpen end mills quickly, expertly, in your own shop. The Head can be detached and used on cutter-grinders, surface-grinders and milling machines for various types of spiral grinding or milling, such as flute grinding, web thinning, tap grinding, step grinding and form relief grinding for end cutting. Send for details now!

SPIRAL STEP TOOL COMPANY

Designers and Manufacturers of All Types of Special Cutting Tools

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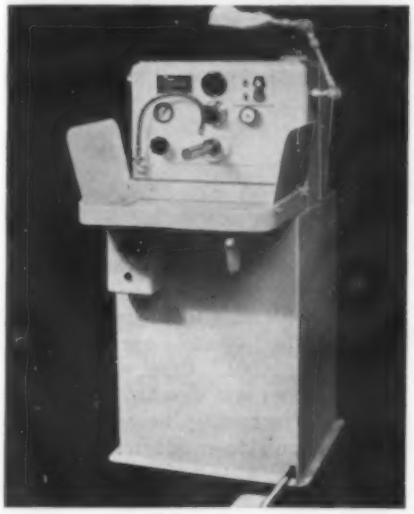
Honing Machine Features Constant Pressure System



A complete hydraulic system which assures constant pressure is one of the features of the new Model H. M. Honemaster, a manually operated honing machine manufactured by Superior Hone Corp., 1637 Elreno St., Elkhart, Ind.

Stone pressure control is adjustable to the diameter of the piece and material being honed. Stone wear or stock removal causes no fall off of pressure. Constant cutting action is assured. The hydraulic system also operates the clutch and brake mechanism.

The single control sizing dial indicator is set by honing the first piece to finish size. Thereafter it is only necessary to compensate for stone wear. This sizing dial indicates when the piece is coming to size.

Infinitely variable spindle speed, 100 to 900 rpm, provides for the right speed for work of any diameter, material or finish. There is an easy to read tachometer. The spindle, with hardened pilot bushing, mounted on factory sealed bearings, requires no lubrication attention.

The hydraulic oil and coolant oil is self-contained in one divided steel fabricated tank. The hydraulic section has an easily accessible filler plug and the hydraulic suction line includes a filter unit. The coolant section has baffle plates as well as an easily accessible strainer basket mounted on the top of the cover.

The machine can be operated from either the foot pedal while standing, or from the knee pedal while sitting. All standard Superior mandrels are adaptable to this new machine. •

Use HANDY Postpaid Card. Circle No. 118

ONE Drill Grinder Sharpens ALL Drills

- 90° to 140° Included Angle
- 1/8" to 2 1/2" Diameter
- 2-3-4 Flutes
- Without Chucks or Collets

Write for complete information on the STERLING Model "DV" Drill Grinder

STERLING Model "DV" Variable Angle DRILL GRINDER

This Tool & Cutter Grinder has BIG CAPACITY

(11" swing—14" between centers)

At LESS Cost

Sterling Model "RK-2" provides more capacity at half the cost of a Universal Grinder. Write for details.

McDONOUGH MFG. CO.

1522 GALLOWAY • EAU CLAIRE, WISCONSIN

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PRESSURE LOK-224

RESINOID DIAMOND WHEELS

— the best diamond wheel bond ever developed —

if you've used them - you know they're best!

if you haven't - let us show you!

UNITED STATES DIAMOND WHEEL CO. AURORA, ILL.

Circle No. 242 on postpaid card

Single End Chip Breaker Grinder

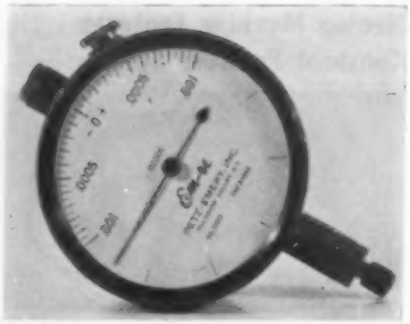
A new chip breaker grinder has been introduced by Hammond Machinery Builders, Inc., 1651 Douglas Ave., Kalamazoo, Mich. Designed for medium-duty, the new model CM-6W is offered as a single end chip breaker grinder only, or as a combination chip breaker and diamond finishing grinder. The new grinder incorporates a self-contained pump and tank unit with special No-Splash guarding. A flood of coolant is provided, giving continuous cool cutting, increasing diamond wheel life, and eliminating dust problems.

Recommended for light or intermittent duty grinding, the CM-6W has a ½ hp built-in drive motor; accommodates 6″ dia. chip breaker wheels, and with cup wheel arrangement uses a 6″ dia. cup wheel. Any-Angle vise with 4 swivel adjustments is furnished on the chip breaker end, providing all angular settings and accommodating tools up to 2-½″. Head raising and lowering adjustments by micrometer dial calibrated to .001″. Cross slide, with micrometer screw and dial calibrated to .001″ moves on dovetail ways with adjustable gib. Carriage slides have protecting guards, and carriage reciprocating lever is adjustable for strokes up to 7″. Equipped with brake lever for quick spindle stopping. Tilting work table on cup wheel end adjusts from 30 above to 30 below horizontal, with table moving in by screw feed. •

Use HANDY Postpaid Card, Circle No. 119

New Dial Indicator with Accuracy to 10 Millionths

Petz-Emery Inc., of Pleasant Valley, N.Y., has added to its existing line of 24 models a newly-designed dial



indicator, Model 21019, that is said to give accurate readings to within ten millionths (.00001″). It is graduated in 50 millionths (.00005″) over a measuring range of .002″. Bezel size is 2¼″. This indicator was developed to satisfy industry's increasing need for closer tolerances and closer adherence to those tolerances.

The precision action of the indicator results from simple construction and fully jeweled movements protected by the exclusive Em-re 100% shock-proof system. Thus, the jewels cannot be damaged and the entire internal mechanism is virtually indestructible. Extensive testing under the severest conditions has failed to impair the indicator's ability to maintain its accuracy. It is made to A.G.D. Group 2 mounting specifications. •

Use HANDY Postpaid Card, Circle No. 120

CUT-OFF Wheels . . .

for Metal and Non-metal

This complete line of Bullard Resinoid Bonded wheels offers a choice of many sizes and styles for all kinds of cutting jobs. They're strong, have high resistance to breakage and a low wear ratio. Made by the specialty manufacturers of cut-off wheels for over 25 years.

Write for new net price list.

BULLARD

Geo. H. Bullard COMPANY INCORPORATED

HOPKINTON ROAD WESTBORO, MASSACHUSETTS

SPECIALTY MANUFACTURERS OF RESINOID BONDED HIGH SPEED GRINDING CUT OFF AND COPING WHEELS

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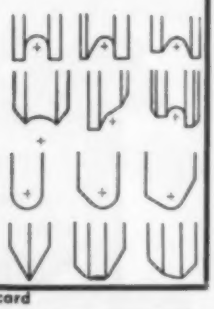
WHY WASTE TIME?

Dress Profiles like these in a few minutes without Templates or Crusher Rolls with the Jeon Automatic Angle Tangent to Radius Dresser. It's fully universal.

Patented



Write for Price and Folder. Representatives Wanted.

CONCAVE DRESSING TOOL

JEON MANUFACTURING CO.

P. O. BOX 6750 WASHINGTON 20, D. C.

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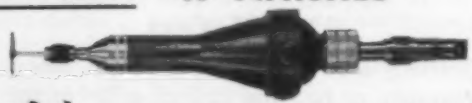
AT AN ANGLE — IT FILES

USED STRAIGHT — IT FINISHES



the Reciprofiler* IT'S THE NEW "3-WAY" TOOL by—

- Rotates and Reciprocates
- Non-Scratching movement
- 1 to 15,000 R.P.M.—stroke 0 to 5/8"
- Files, hones, saws, laps, polishes, shafes, grinds, mills, engraves, etc.

*TRADE NAME—Pats. Pend.

Nord Corporation

14 SPRUCE STREET

NUTLEY, NEW JERSEY

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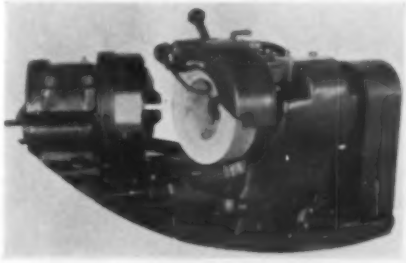
Wet Drill Pointer Offers Alternative Coolant Supply



The Oliver model No. 510 semi-automatic wet drill pointer is now available with two alternative methods of supplying the coolant to the tool area being ground.

The standard wet type drill pointing machine is equipped so that the coolant is discharged directly on the surface of the drill point and the adjacent area of the grinding wheel. This has been the common method employed by industry especially in the grinding of large diameter high speed steel drills and carbon steel drills.

The first alternative method now available is the substitution of "water through the wheel". In this particular instance it is necessary for the user to purchase a grinding wheel with the outside diameter sealed. The sealing of the outside diameter of the grinding wheel precludes the misdirection of the coolant due to centrifugal force. Since the grinding wheel employed is of a cup type with steel backing the only egress for the coolant is in the direction of the tool being ground.

The second alternative method available to the user is a combination of the two units described above. This set up permits a flow of coolant both on the surface of the grinding wheel and the tool being ground as well as through the wheel. The use of water through the wheel further assures the user of a cool grind. Oliver Instrument Co., 1408 E. Maumee St., Adrian, Mich. •

Use HANDY Postpaid Card. Circle No. 121

Reinforced Depressed Center Type Disc Wheel

A new modified reinforced depressed center type disc wheel, called the Tuf-Cut, has been announced by Precision Grinding Wheel Co., Inc., 8301 Torresdale Ave., Philadelphia 36, Pa.

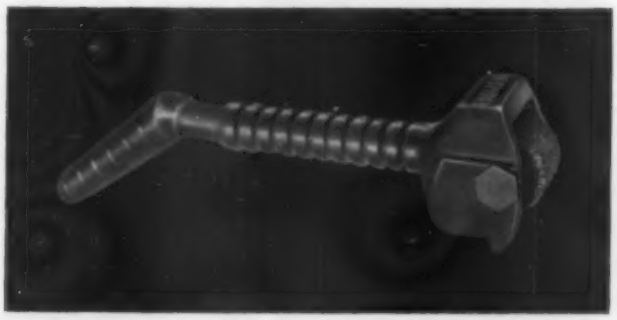
It is saucer shaped with the grinding angle already built in. It permits the operator to assume a more comfortable position, eliminates fatigue, permitting increased efficiency. The operator only has to tilt the heel of the saucer instead of raising the machine to the conventional clearance angle. Additionally, the saucer can be used flat for overall surfacing. Another advantage is its ability to cut into sharp corners and hard to get at angular places without tilting.

It is available in both 7" and 9" diameters in ¼" thickness and shippable immediately from stock. Operating speeds are the same as for regular depressed center discs. Special adaptors designated as TC2 are required for mounting.

Tuf-Cut saucers are used on the same machines as discs for grinding steel and iron castings, plates, weldments, etc. They can be used down to the arbor and on both sides. The same specification is usable for all operations with increased production, at no increase in price. •

Use HANDY Postpaid Card. Circle No. 122

40% LONGER LIFE!



For coated abrasive belts, Desmond's new BELTBRASIVE dresser lengthens service life an average 40%—substantially increases stock removal at the same time. Works on discs, belts, polishers—saves changing time. Apply BELTBRASIVE dresser lightly when abrasive begins to load. Ask your Desmond distributor or write for bulletin D-12.

The only complete line of grinding wheel dressers and cutters

Desmond

THE DESMOND-STEPHAN MFG. CO., URBANA, OHIO

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THE VONNEGUT BRUSH-BACKED POLISHING HEAD

Its versatility makes it a "must" in every shop!

The Vonnegut Brush-Backed Polishing Head, in a choice of diameters and abrasive widths, is versatile in the OPERATIONS for which it can be used, in the MATERIALS and the SHAPE AND FORM OF SURFACES to which it can be applied. It will sand, polish, deburr, flat or contoured surfaces—on wood, metals and other materials. Write for Bulletin No. 102 for full description.

Makers of the famous MARSCHKE grinders and buffers.

Grinding and Polishing Machinery Corp.

SUCCESSORS TO VONNEGUT MOULDER CORPORATION

2530-B WINTHROP AVE., INDIANAPOLIS 5, INDIANA

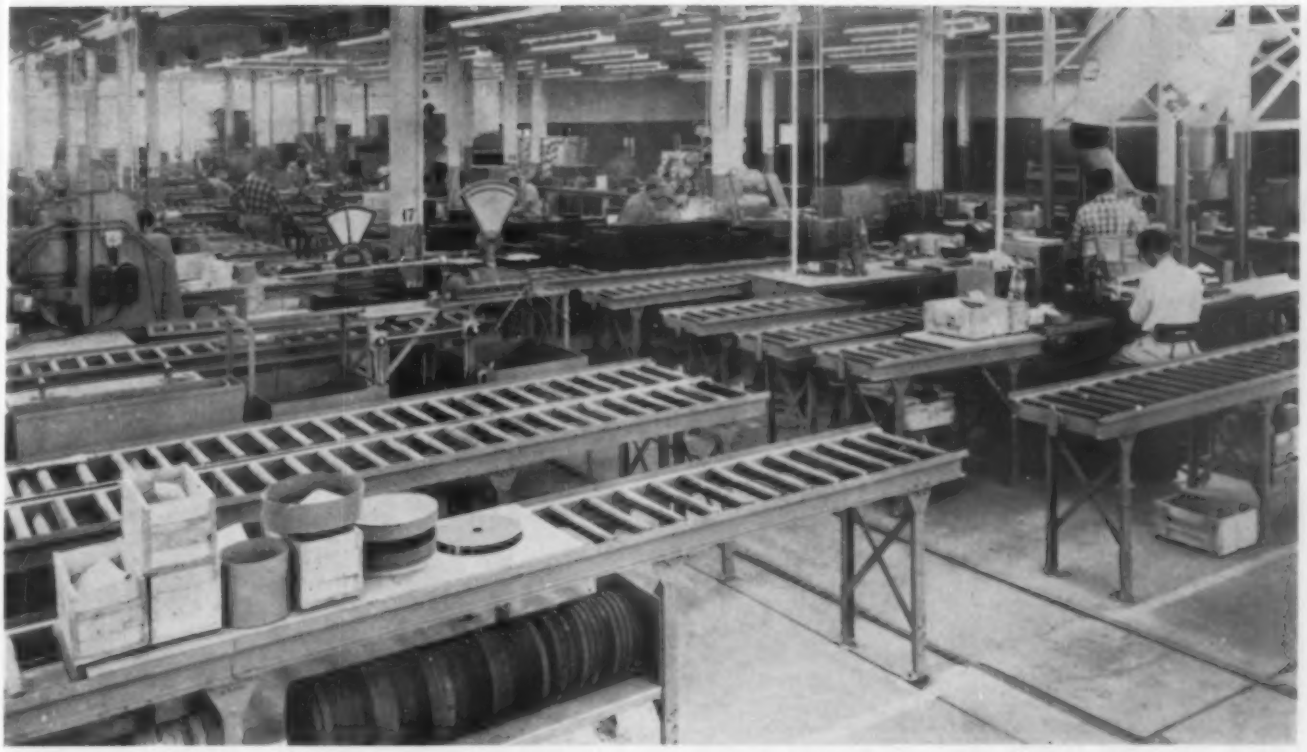
Circle No. 247 on postpaid card

New Norton Company plant at Santa Clara, California.

California Grinding

George A. Garrison, manager of the new Santa Clara plant.

Applying blotters to grinding wheels. Blotters serve a dual purpose. They serve to identify the wheel and also provide a protective cushion between the wheel and the mounting flanges.



General view of finishing department where wheels are trued, inspected, blottered and packed for shipment. Wide use of roller conveyor system reduces manual handling to a minimum.

Wheel Plant for Norton Company

New installation affords central location for the West Coast market.

• Norton Company's new grinding wheel plant at Santa Clara, California, was officially opened May 7, with a three day open house program. President Milton P. Higgins was host to editors of the technical press and newspapers, city officials, and employees and their families who were invited to the opening event.

"We located here because of the central location close to the entire West Coast market, good living conditions and fine transportation facilities," Higgins said. "We are particularly pleased to be a part of this great and fast-growing economy."

This plant, the only one on the West Coast making a complete line of grinding wheels, including diamond wheels, incorporates the latest developments in the industry. These include many pieces of equipment and methods developed at the main plant in Worcester, Mass. Typical of these are the automatic electric tunnel kilns which accurately control the temperatures of the kilns during firing, automatic molding machines for small diameter wheels which insure complete uniformity of the size and density of the finished product, dust control equipment which insures cleaner air than that which is found in the average home, and modern handling equipment which reduces manual handling to a bare minimum.

The lighting level throughout the plant is 40 to 60 footcandles at the working level. This uniformly high lighting level combined with restful color combinations eliminate glare and contribute to the excellent working conditions. Part of the plant is air conditioned where the manufacture of the product requires uniform atmospheric conditions.

At the present time, about 80 people are employed at the Santa Clara plant. Manufacturing began late in 1955 with the first grinding wheels being produced in December. Grinding wheels from this plant are now in use all over the West Coast. Because of the plant's proximity to the Western market, deliveries to customers in the area have been appreciably shortened. Deliveries of many emergency orders have been made overnight whereas formerly such deliveries, even by air, took several days to a week to arrive from New England.

On hand to greet the visitors during the three day program, in addition to Mr. Higgins, were plant manager, George A. Garrison; Ralph F. Gow, executive vice president; John Jeppson, vice president in charge of manufacturing, Abrasive Division; Ralph M. Johnson, vice president in charge of sales, Abrasive Division; Donald L. Price, sales manager, Abrasive Division; and Elliott B. Knowlton, public relations manager.

Products made in the Santa Clara plant include grinding wheels, mounted points, segments and diamond wheels. These are made with both vitrified and resinoid bonds. Wheels up to 14" in diameter can be made here at the present time.

There is ample stock storage space to keep on hand for immediate delivery large size and special wheels made at the main plant in Worcester, Mass. Stock wheels up to 40" in diameter can be altered to meet specifications on the truing machines in this plant.

The property includes about 15 acres at the site of the new plant. The last 7½ acres was purchased in March, 1956. Norton purchased the plant in 1954 and began converting the building

Packing area where grinding wheels are prepared for shipment. Overhead chutes contain sawdust, used to protect wheels in transit.

Electrically heated tunnel kiln used to fire the vitrified grinding wheels made at the plant. Controls for the kiln are located overhead.

into a grinding wheel plant in 1955. The plant was formerly used for making glass fiber products. Present employment is about 80 people. All except six supervisory and technical people were hired locally.

Santa Clara is one of the newest of the 20 Norton plants located in 10 countries, and is the first grinding wheel plant in the U.S. outside of the main plant in Worcester. The latest is a coated abrasives plant in Buenos Aires, Argentina. Controlling interest in the South American plant was purchased in March, 1956. Norton Company operates a bauxite mine at Bauxite, Arkansas, electric furnace plants at Huntsville, Alabama; Chippawa, Ontario; and Cap-de-la-Madeleine, Quebec. Behr-Manning Company of Troy, New York, is the Norton Division that manufactures coated abrasives and industrial tapes. They also operate Norton-Pike Company of Littleton, New Hampshire, makers of natural and manufactured oil stones. Foreign sales and management of overseas plants is handled by Norton Behr-Manning Overseas Inc. This corporation operates grinding wheel plants in Canada, England, Germany, France, Italy, South Africa and Australia. It also operates coated abrasives plants in Canada, Northern Ireland, France, Australia and the new Argentine plants. • • •

DIAMOND DRESSERS for THREAD GRINDERS

Guaranteed Tolerances $2.50

Complete line of Diamond Wheels and Tools

ALLSTATE DIAMOND PRODUCTS

80-82 Bowery CA 6-2560 N. Y. 13, N.Y.

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FOR SALE

1—Blakeslee Model DP Degreaser. Used two weeks.

1—Custom Blakeslee, Model TE-YP Vapor-Spray Type, Boiler & Still, Pumps & Tanks. Suitable for high production.

1—Victor-Peninsular Gas Fired Continuous Drawing Furnace with Motors, Controls, Conveyor Feed, etc.

ALL IN EXCELLENT CONDITION IMMEDIATELY AVAILABLE INFORMATION ON REQUEST.

MR. G. FORWARD

OTTO BERNZ CO., INC.

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Trophy Winners at Armour and Co.

Picture shows trophy award winners at the General Sales Conference, Coated Abrasives Div., Armour and Co., held at the Elks Club in Alliance, O.

From left to right are: L. J. Urschler, E. M. Baker, E. Marin, M. K. Shetler, S. Shetler, T. J. Duddy, and Robert L. Reeves, Divisional General Manager. Shetler, district sales supervisor, was awarded a salesman's trophy for highest dollar volume sales in the Division for 1955. Baker received his trophy for highest dollar volume increase during 1955. Urschler, Marin, and Duddy, district sales supervisors, received their trophies for outstanding sales progress during 1955. Reeves presented the trophies. Mr. S. Shetler is the father of M. K. Shetler, and is also employed in the Coated Abrasives Division.

Brown & Sharpe Establishes Precision Center in Providence

It offers an opportunity to observe, discuss and study the application of the many types and sizes of machine tools and industrial products

Last May marked the establishment in Providence, R.I., of Precision Center, a unique institution in the metalworking world, and one which Brown & Sharpe hopes will be symbolic of an important era of cooperation between the company, its front line dealers, and the user customers.

Henry D. Sharpe, Jr., president of the company states that since Precision Center was first put in use, evidence is already seen of the two-way method of its operation. "To be sure, we have informed our users and dealers of what we have to offer," Sharpe said, "but they in turn have brought to us new thoughts, new attitudes, and renewed enthusiasm for the future."

Precision Center occupies a large area in one of the main buildings in the plant, and was designed to provide a pleasing, modern atmosphere of color and convenience. The Center is made up of a screw machine section, industrial products section, grinding machine section, and milling machine section.

• • •

News of the Industry

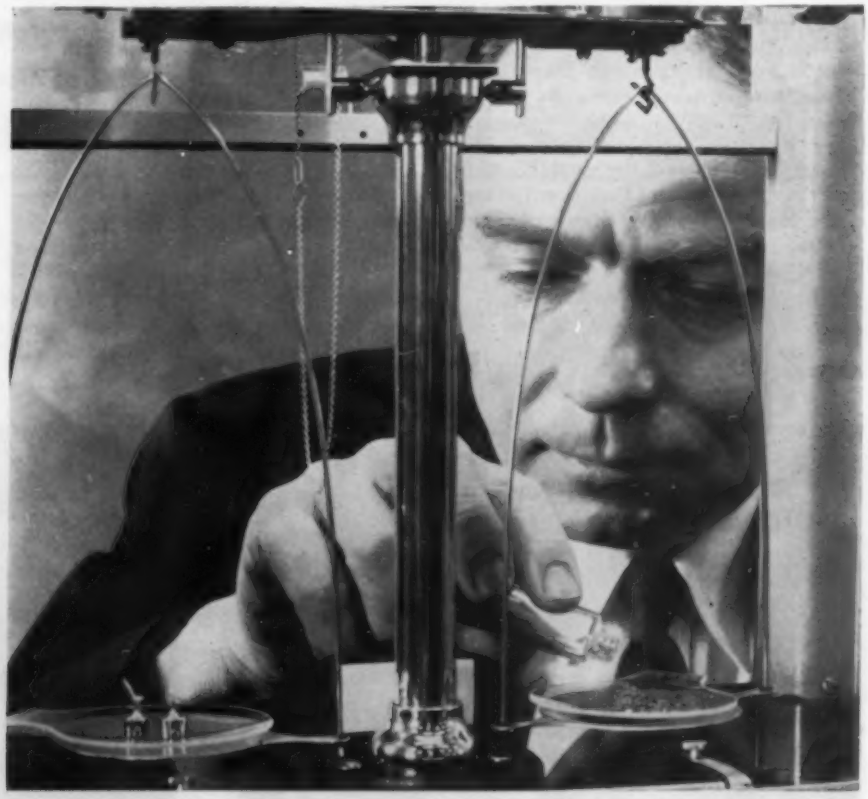
Man-Made Diamonds Presented to Smithsonian Institute by G-E's Carboloy Department

Man-Made industrial diamonds are now being produced in limited quantities at the Detroit pilot plant of General Electric's Carboloy Department.

This announcement was part of the ceremonies marking the presentation to the Smithsonian Institution of a cluster of General Electric's first man-made diamonds.

"Since 1954, when the first diamonds were made in the G-E Research Laboratory in Schenectady, we have been making steady progress in bridging the gap between the first experiments and the production line," J. S. Gillespie, manager of Carboloy's diamond project stated.

He pointed out that the two main



One-Hundred carats of the first man-made diamonds produced in the pilot plant of G. E.'s Carboloy Department, Detroit, are being weighed here. J. S. Gillespie, manager of Carboloy's diamond project, weighed the industrial diamonds which have been mounted in a special plaque presented to the Smithsonian Institution in Washington.

Focal point of the exhibit is the cluster shown above, about ¼ inch in diameter, consisting of some of the first man-made diamonds produced in the GE Research Laboratory. Here the cluster is compared with a Rockwell hardness tester. Industrial diamonds could become a $200 million annual business within 10 years, if the price is right, according to a forecast by J. S. Gillespie, manager of the diamond project at GE's Carboloy Department in Detroit.

areas of concentration are the production of man-made diamonds in quantity, and at a marketable price. While progress is being made on both these problems, Gillespie stressed that there is "still more to be accomplished before we will have industrial diamonds commercially available."

The supply of industrial diamonds is essential to U. S. industry. In an emergency, it is possible that the source of natural stones, South Africa and South America, could be cut off and, if this happened, many key industrial processes would be greatly handicapped. A domestic source of man-made diamonds, identical in every way to natural industrial diamonds, would help make this nation independent of the natural source, Gillespie pointed out.

Gillespie has estimated the industrial diamond business as having a $200 million dollar potential within the next decade—if the cost of the man-made diamonds can be brought down below those now being mined.

Much of this potential, according to Gillespie, is caused by the increasing demand for high production of interchangeable parts which must be held to very close tolerances. Diamonds are used for finishing these parts and for shaping and dressing grinding wheels that produce these tolerances.

"Commercial diamonds are now being consumed at the rate of 12 million carats a year. This represents a $50 million dollar business," he said, "with about 80 per cent of these, by weight, going into grinding wheels, the balance in rock drills, wheel dressers, metal cutting tools and dies."

New Address for Clipper Diamond Tool

Clipper Diamond Tool Co., Inc., has moved to larger quarters at 345 Hudson St., New York 14, according to Joe Klipper, vice-president and general manager.

Clipper's business has tripled in the past five years. The increase was felt right down the line of Clipper's products which include diamond dressers, boring tools, improved tungsten carbide impregnated tools, and resin, metal, and vitreous bonded diamond wheels. An item which has attracted a great deal of attention is their Cera-Met bonded diamond wheel, a novel bonding material claimed to be a considerable advance and to afford greater efficiency for general purpose off-hand grinding of carbides.

Buckeye Tools Appoints New Representative

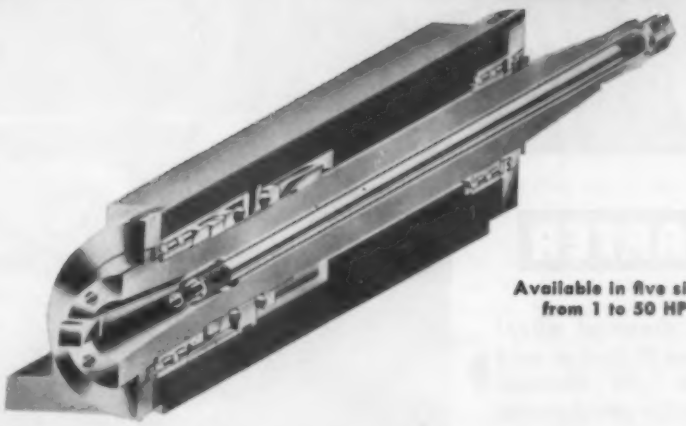
Abrasive Machine Methods Corp., Cleveland, has been appointed exclusive representative in Northeastern Ohio for Buckeye Tools Corporation, Dayton. AMMCO, operating from headquarters at 8224 Carnegie, Cleveland 3, will offer complete sales and service, including tool repairs, to portable tool users in the Cleveland - Akron - Canton industrial areas.

Salesman 30 to 60 who has sold buffs or supplies in New York, New Jersey and Philadelphia, to sell machinery.

Write Box GF-7
c/o GRINDING & FINISHING
222 E. Willow Wheaton, Illinois

Your BEST PACKAGED BUY in milling spindles

POPE HEAVY DUTY PRECISION SPINDLES



Available in five sizes from 1 to 50 HP

POPE HEAVY DUTY MOTORIZED MILLING MACHINE SPINDLES are available in P-2500 Series, from 1 to 100 HP, totally-enclosed, fan cooled; also in high cycle, water cooled units.

P-12000 Series *Belt Driven* in sizes from 1 to 50 HP, with Standard milling machine tapers in the nose from #10 to #60. *Operable in any position you specify.*

See: the big shaft, the heavy duty double row cylindrical roller bearings and thrust bearings that have extra ability and the rigidity to support your cutting tools.

For complete dimensions, write for Bulletin S-8.

You can specify POPE PRECISION SPINDLES with Confidence No. 110

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

Circle No. 254 on postpaid card

Industrial Materials Company Appointed as Speed-D-Burr Distributor

Industrial Materials Co., San Francisco distributors of abrasive, chemical, sanding and grinding equipment, has been appointed by Speed-D-Burr Corp., Glendale, Calif. manufacturer of precision barrel finishing equipment, as distributors for the Bay Area, Central and Northern California.

Speed-D-Burr equipment is available for personal inspection and operation in the complete processing department for test and experimental work, pilot runs, customer process development and job shop barrel finishing that has been installed by Industrial Materials Co. to give local engineering and customer service for all barrel finishing equipment, media, compounds and supplies. This most modern barrel finishing department in the Bay Area will be operated as a subsidiary company known as the Micro-matic Deburring Co., 1447 34th St., Oakland, Calif., and will be under the supervision of W. T. Elmas, who has many years of eastern experience in the finishing field as well as a background of experience at the home office of Speed-D-Burr.

High Precision Production Here

ARTER

Using diamond wheel to grind O.D. of a solid carbide 1/16" diameter end mill – dead center work head used.

Twelve of a battery of twenty-four Arter Model 103 cylindrical grinders in the highly modern plant of The Atrax Company, Newington, Conn. This nationally known progressive company produces precision ground carbide tools — end mills, reamers, drills, grinding tools, burs, bur mills, boring tools and boring bits. Atrax also has some of these versatile Arters set up for internal grinding. Whether you have external cylindrical or internal grinding, it will pay you to look into this grinder.

ARTER GRINDING MACHINE COMPANY

WORCESTER 5, MASSACHUSETTS

Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders

AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

Circle No. 250 on postpaid card

Linwood W. Elliott Dies

Linwood W. Elliott, 75, senior field engineer for the Lobdell United Div. of United Engineering and Foundry Co., Wilmington, Del., was stricken while on a business trip for the firm and died April 12, in a hospital in Beaumont, Texas. He was the victim of a heart attack while visiting a Texas paper mill, and suffered another attack after being removed to the hospital. He had left Wilmington about four weeks previously.

Elliott was one of the leading experts in the United States on roll grinding and the handling of chilled iron rolls. He had been with the Lobdell United Division and its predecessor, the Lobdell Company, since he was about 16 years old. He was born in Laurel, Del., but had lived in Wilmington since his youth.

Production Tool Corp. Expands

Production Tool Corp., Chicago, has purchased Kuma Tool Co., Chicago, manufacturer of precision tools and equipment, according to Henry P. Brooks, president of Production Tool. Kuma Tool, under present management, will be operated as a division of Production Tool, Brooks said.

Covel Mfg. Appoints J. Lee Hackett Co. as Representative

Covel Mfg. Co. of Benton Harbor, Mich., has announced the appointment of the J. Lee Hackett Co. of Detroit as the exclusive distributor for Covel and Covel-Excel precision grinding machines in Eastern Michigan.

The Hackett Co. has been a leading machine tool distributor in Michigan for many years. Covel Manufacturing Company has been in business for 82 years, having started in 1874 as manufacturers of saw-sharpening equipment. They have been building precision grinding machines since 1927 when they acquired the Wilmarth and Morman Co. of Grand Rapids, Mich.

INDEX TO ADVERTISERS AND PRODUCTS

(With a List of Their Advertising Agencies)

A

Abrasive Machine Tool Company (Surface Grinders) 9
Creamer-Trowbridge
Aget Manufacturing Company (Dust Filters) 74
Beeson-Reichert, Inc.
Allstate Diamond Products (Diamond Dressers) 80
Anderson Brothers Manufacturing Co. (Balancing Units) 67
Cummings, Brand & McPherson
Anton Machine Works (Magnetic Work Holders) 46
Richard & Gunther, Inc.
Arter Grinding Machine Company (Grinding Machines) 84
John W. Odlin Company, Inc.

B

Bay State Abrasive Products Co. (Grinding Wheels) 34, 35
Berg-Marshall, Inc.
Bearings, Inc. (Spindle Repair Service) 69
Brad Wright Smith Advertising, Inc.
Blanchard Machine Company (Grinding Wheels) 12
Henry A. Loudon Advertising, Inc.
Bullard Company, Inc., George H. (Cut-Off Wheels) 76
Ad-Service, Inc.

C

Carborundum Co. (Diamond Wheels, Pad Assemblies) .. 53, 54
Comstock & Company
Carroll Pressed Metal Co. (Grinding Wheel Inserts) 66
Berg-Marshall, Inc.
Casalbi Company, Globe Div. (Barrel Finishing Equipment) 4
Rumsey & Associates
Chicago Wheel & Manufacturing Co. (Mounted Wheels) 22
Frank C. Nahser, Inc.
Cincinnati Electrical Tool Company (Spindles) 62
Perry-Brown, Inc.
Cincinnati Milling Machine Co. (Grinding Machines) 2, 3
Jaap-Orr Advertising Agency
Cleveland Grinding Machine Co. (Precision Grinders) 61
Ohio Advertising Agency
Covel Manufacturing Company (Precision Grinders) 20
Paxson, Inc.
Crystal Lake Grinders (Grinding Machines) 86

D

Desmond-Stephan Company (Belt Dressers) 77
Odiorne Industrial Advertising
Diamond Tool Research Association (Diamond Tools) 68
Preiss & Brown Adv.

E

Erickson Tool Company (Expanding Mandrels) ..... 4th Cover
Palm & Patterson, Inc.
Exolon Company, The (Tumbling Abrasives) 48
Melvin F. Hall Advertising, Inc.

F

Fulmer Company, C. Allen (Honing Machines) 52
Julian J. Behr

G

Globe Div., Casalbi Company (Barrel Finishing Equipment) 4
Rumsey & Associates
Grinding and Polishing Machinery Corp. (Polishing Heads) 77
Saas and Sogard, Inc.

J

J & S Tool Company, Inc. (Live Centers) 6
Gordon A. Pihl & Associates
Jeon Manufacturing Company (Dressing Tools) 76

K

Keystone Abrasive Wheel Co. (Grinding Wheels) 36
G. Norman Burk, Inc.

L

Lassy Tool Company (V-Blocks and Angle Plates) 74

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Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

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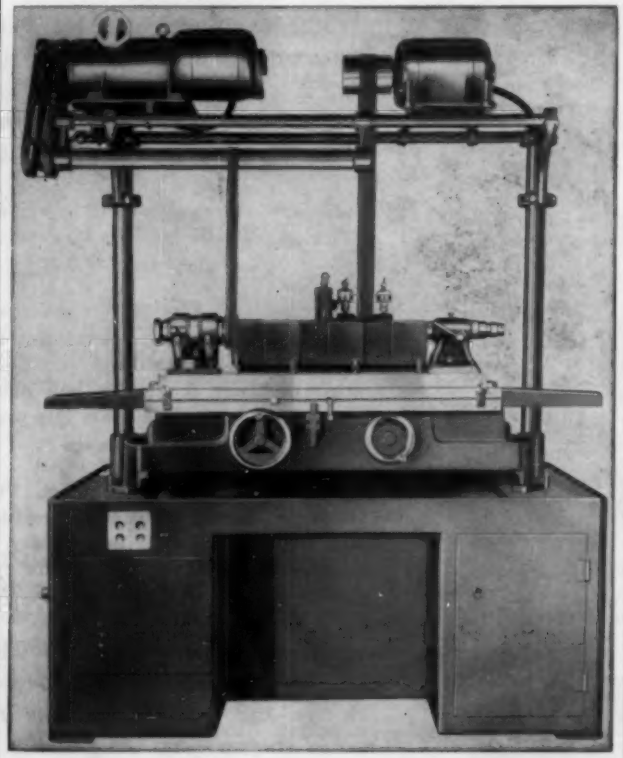
Your 1956 Crystal Lake Grinder can be equipped with Rex Super Van High Speed Steel, double taper spindles. Due to their high hardness, high tungsten content, spindles will run without clearance in bearings after they have been stabilized and ground to .000005 in. roundness. Spindles are set in boxes with heavy oil drag, and, DUE TO THE NINETY DEGREE OVERHEAD DRIVE, AMPLE POWER CAN BE USED TO ROTATE SPINDLE WITHOUT HEADSTOCK AND WHEELHEAD BECOMING CUMBERSOME AND HEAVY TO MOVE FOR SHOULDER GRINDING, ALSO, BELT PRESSURE IS NINETY DEGREES FROM GRINDING PRESSURE.



A choice of General Electric Thymotrol, General Radio Variac, or Variable Speed Drive can be used without ripple or cine' wave being transmitted to work as all motors are mounted on self-contained countershaft.

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Since 1910

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M

Macklin Company (Grinding Segments) 16
Rumsey & Associates
Manhattan Rubber Div., Raybestos-Manhattan, Inc. (Cut-Off Wheels) 5
Roland G. E. Ullman Organization
McDonough Manufacturing Company (Drill Grinders) 75
Keystone Advertising, Inc.
Micromatic Hone Corp. (Honing Tools & Machines) 17
Gray & Kilgore, Inc.
Midwest Abrasive Company (Grinding Wheels) ..... 2nd Cover
Marvin Hahn, Inc.
Minnesota Mining & Manufacturing Co. (Barrel Finishing Abrasives, Abrasive Belts) 41, 63
Batten, Barton, Durstine & Osborn, Inc.

N

Nielsen, Inc. (Live Centers) 65
Nord Corporation (Reciprocal Hand Machines) 76
Advent Associates, Inc.
Norton Company, The (Grinding Wheels and Abrasives) 18, 19
James Thomas Chirurg
Nu-Matic Grinders, Inc. (Grinding Wheels) 73
The Dwight Miller Company

P

Pope Machinery Corp. (Precision Spindles) 83
Walter B. Snow & Staff, Inc.
Precise Products Corp. (Power Quills) 72
Allen Advertising Agency
Precision Grinding Wheel Company (Grinding Wheels) 40
Production Machine Co. (Centerless Grinding Machines) 71
Charles Palm Company

R

Raybestos Manhattan, Inc., Manhattan Rubber Div. (Cut-Off Wheels) 5
Roland G. E. Ullman Organization
Roto-Finish Company (Finishing Equipment) 70
The Jaqua Company, Advertising

S

Simonds Abrasive Company (Grinding Wheels) 45
Fox & Mackenzie Advertising
Simonds Worden White Company (Grinding Wheels) 8
Ralph E. Cooper Company
Spiral Step Tool Company (End Mill Grinding Fixture) 74
Edward C. Kennedy Advertising
Sterling Grinding Wheel Co. (Grinding Wheels) .... 3rd Cover
Brooke, Smith, French & Dorrance, Inc.
Stone Machinery Company (Cut-Off Machinery) 58
Barlow Advertising Agency, Inc.
Sunnen Products Company (Honing Machines) 49
H. George Bloch Advertising
Superior Hone Corp. (Honing Machines) 59
Wendt Advertising Agency

T

Taft-Peirce Manufacturing Company (Surface Grinders) 55
Sutherland-Abbott
Thompson Grinder Company (Surface Grinders) 14, 15
Emerson H. Mook, Inc.

U

United States Diamond Wheel Co. (Diamond Wheels) 75

V

Van Norman Company (Centerless Grinders) 10, 11
Sutherland Abbott
Vulcan Tool Company (Rotary Tables & Adapters) 85
Chester C. Moreland Company

W

Walls Sales Corp. (Belt Sanders) 72
The Powerad Company Advertising
Wheel Trueing Tool Company (Dressing Tools and Industrial Diamonds) 13
Clark & Robertz
White & Bagley Company (Industrial Lubricants) 7
John C. Dowd, Inc.

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Five elements normally make up the formula of a grinding wheel—abrasive grain, size, grade, structure, and bond. But, in a Sterling wheel, you can get the *sixth* element.

This *sixth* element is the *human* element. It takes into consideration the important factors that never show up in a grinding wheel specification. These include the operator himself, how he works, and all the "little" things that make *your* grinding job different from all others. And it's surprising how much these factors can mean in money and performance.

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Grinding 4"-diameter boring-machine spindle.

"Wheels of Industry"—Vitrified and Resinoid—to meet the exact requirements of industry.

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"THE WHEELS OF INDUSTRY" STERLING

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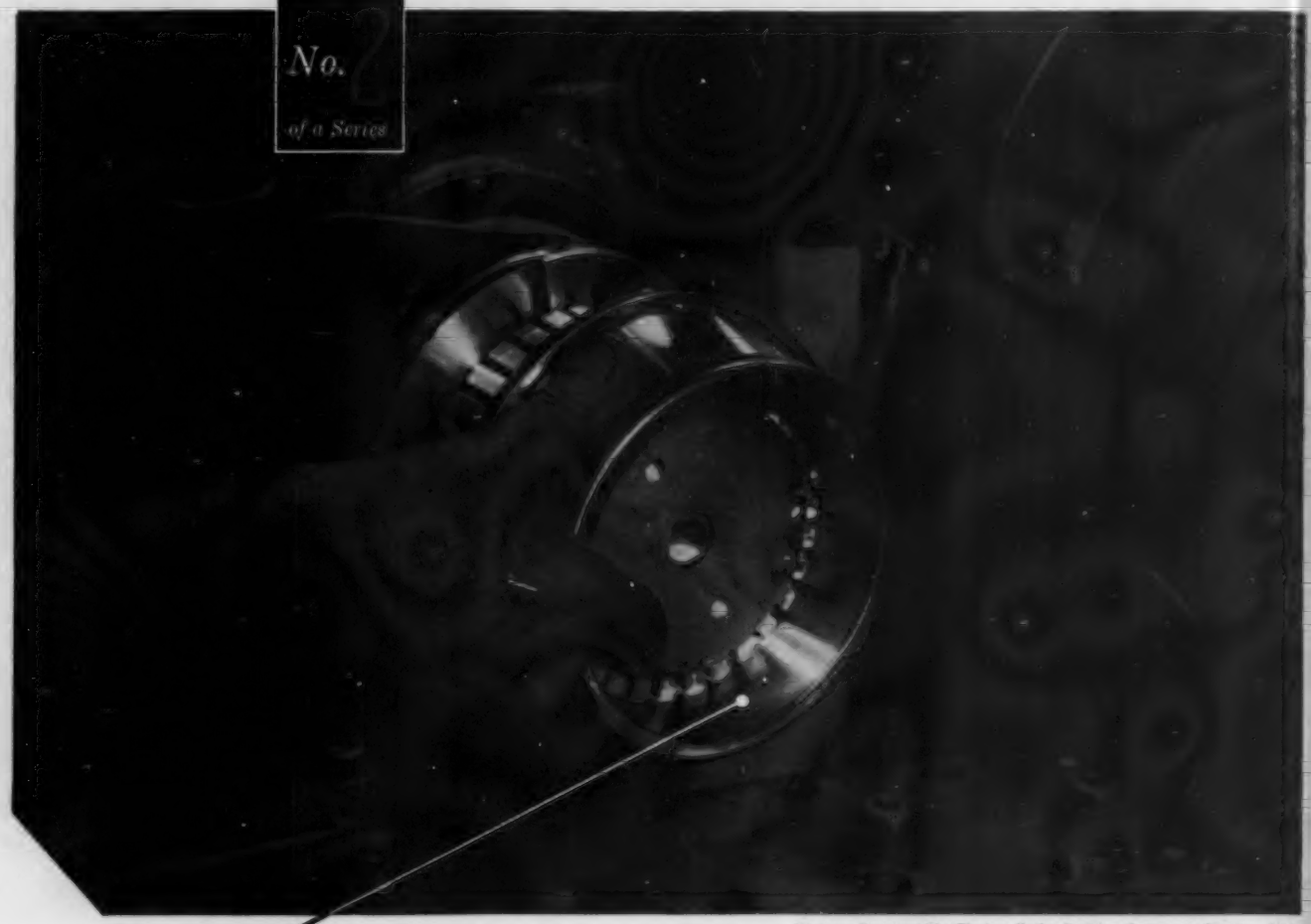

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e.g. roller bearing races

Unusual accuracy is required in the manufacture of tapered-roller bearings. That's why The Timken Roller Bearing Company, leading producer of tapered-roller bearings, uses Erickson precision expanding mandrels for rough and finish grinding of roller bearing races. For in addition to their ability to hold to closest tolerances consistently, they have instantaneous release feature that speeds loading and unloading—for real production dividends.

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AA-2651

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Tap Chucks
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ERICKSON TOOL COMPANY
2310-6 Hamilton Ave. Cleveland 14, Ohio

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Air-Operated Chucks
Expanding Mandrels
Special Holding Fixtures

Closeup of Erickson precision expanding mandrel as used by Timken®. In special application illustrated, Erickson mandrels can hold one ten-thousandth of an inch (.0001") concentricity.

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